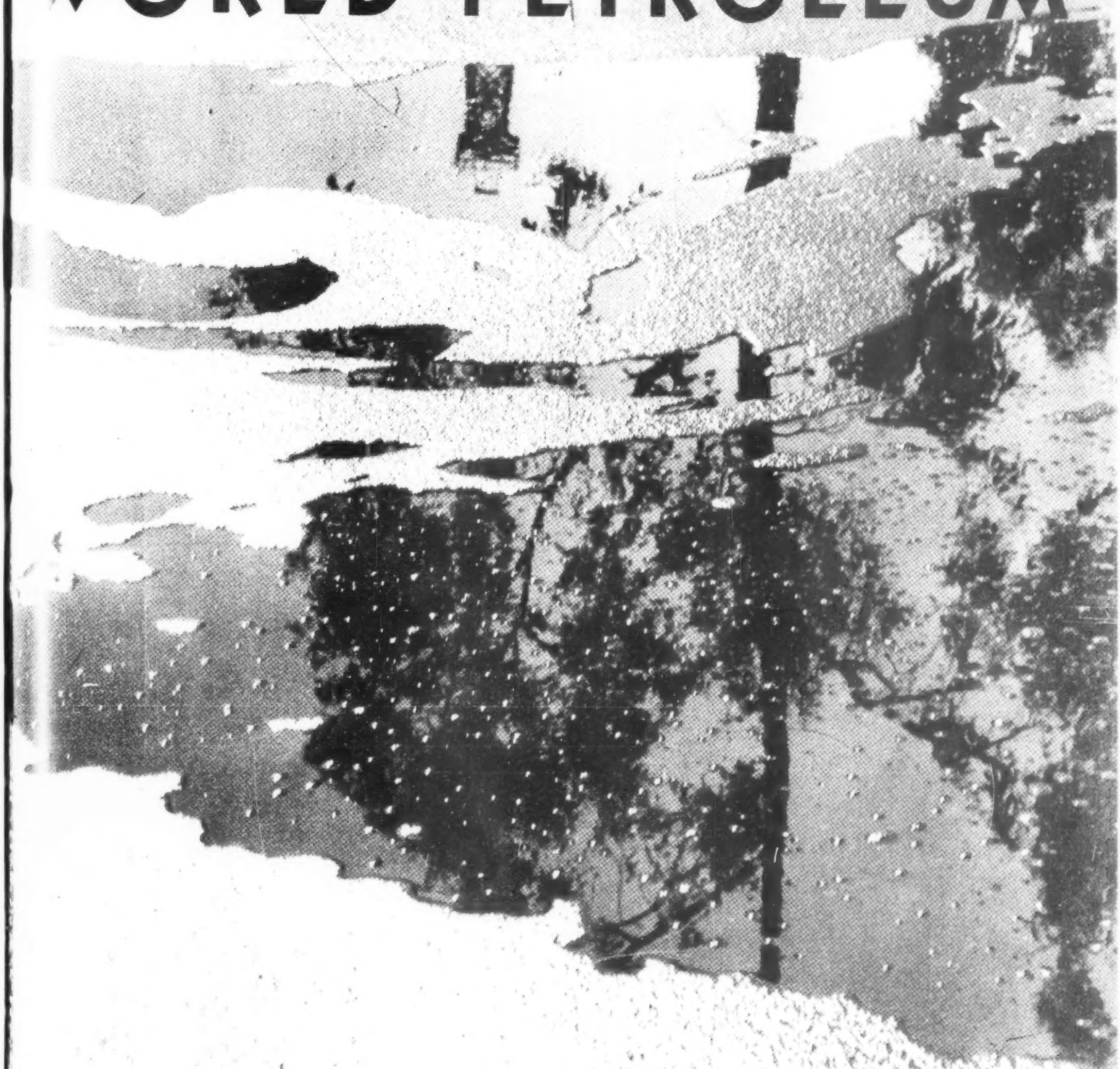
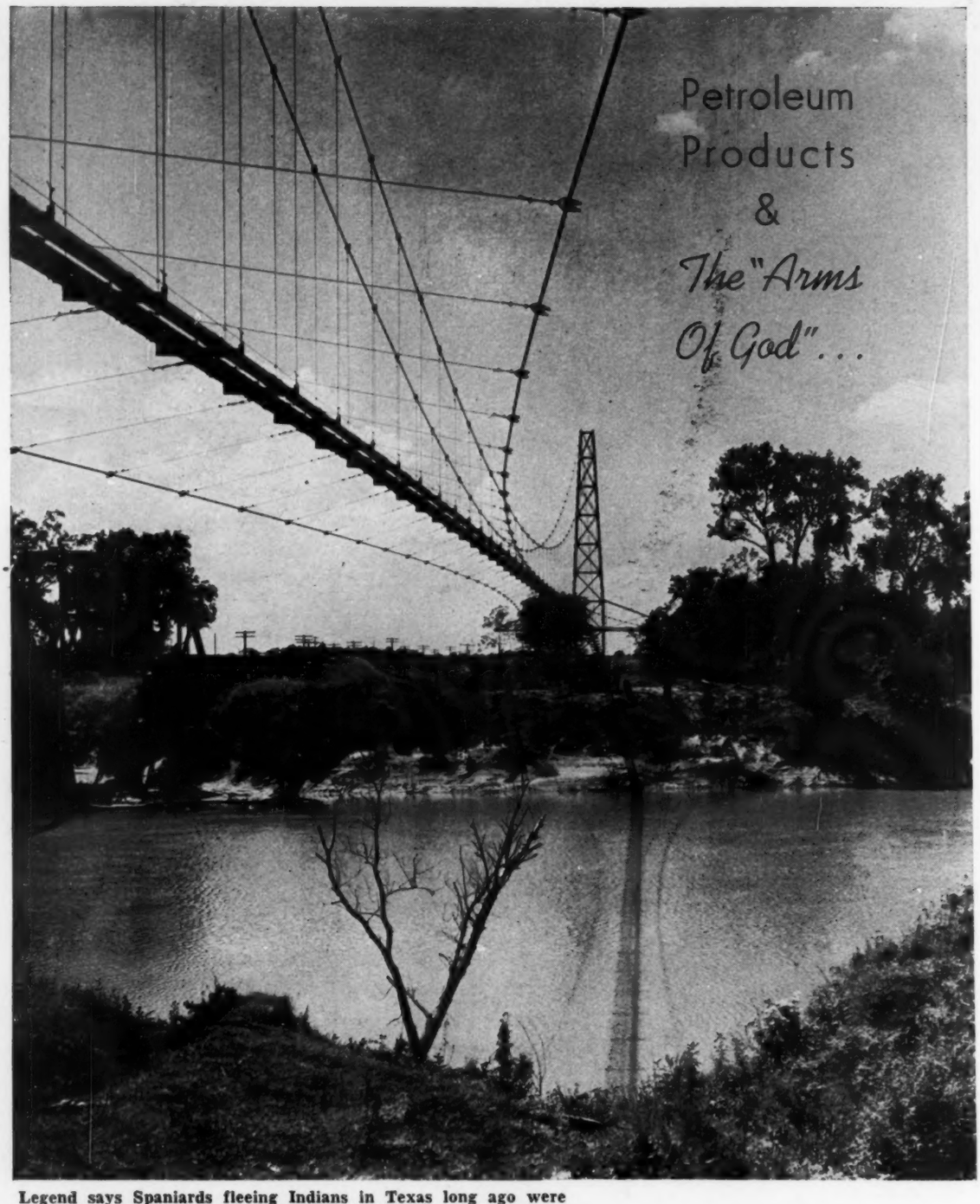
nce brary

DEC 31 1947

# WORLD PETROLEUM



DECEMBER, 1947 FIVE DOLLARS PER YEAR FIFTY CENTS PER COPY




**Legend says Spaniards fleeing Indians in Texas long ago were saved when a sudden flood in a stream they had just crossed stopped the savages. Thankfully, they named the protecting river the "Arms of God," in Spanish, "Brazos del Dios," now shortened to Brazos.** Modern Brazos floods seem heedless of whose path they block, but flow of petroleum products in the 8-inch line above will never the interrupted. Brown & Root, Inc. have bridged the Brazos near Sealy with a 625-foot (between towers) pipe line crossing of their design, fabrication and erection. Take your river problems to Brown & Root, Inc.

**BROWN & ROOT, INC.**

P. O. Box 2634, Houston, Texas

# WORLD PETROLEUM

*Founded by Russell Palmer*

PUBLISHED BY MONA PALMER

THE MANAGEMENT PUBLICATION OF THE INTERNATIONAL PETROLEUM INDUSTRY

**E. W. Mayo**
*Editor*

**J. C. Chatfield**
*Managing Editor*

**Richard Sala**
*Art Director*

SUBSCRIPTIONS

Annual subscription $5.00 (U. S.) postpaid
*Single copies 50 cents*

GENERAL OFFICES

2 West 45th Street, New York 19, N. Y.
*(Tel. MUrray Hill 2-7333)*

BRANCH OFFICES

LONDON: Georgian House, St. James, London S. W. I.

CHICAGO 1: W. R. Cotton, Mid-West Advertising Manager, 307 No. Michigan Ave., *(Tel. Franklin 2508)*

CLEVELAND 14: F. J. Enright, Cleveland Advertising Manager, Union Commerce Bldg., *(Tel. Main 5693)*

DETROIT 2: R. F. Pickrell, Michigan Manager, 314 Stephenson Bldg., *(Tel. Trinity 1-0709)*

LOS ANGELES 14: W. S. Johnson, Western Advertising Manager, 412 West 6th Street, *(Tel. Mutual 1391)*

NEW YORK 19: R. F. Scholbe, Eastern Advertising Manager, 2 West 45th Street, *(Tel. MUrray Hill 2-7333)*

TULSA 3: O. F. Cozier, Mid-Continent Advertising Manager, 515 McBirney Bldg., *(Tel. 4-5555)*

World Petroleum is published by Mona Palmer, Trustee under the will of Russell Palmer

## CONTENTS

**VOLUME 18 DECEMBER, 1947 NUMBER 13**

Oil Industry Faces New Problems ..... 39

ERP Makes Demands on U. S. Oil ..... 40

Tidelands Produces Eight Percent California Crude ..... 42

Fuel Oil Poses Long-Range Problems ..... 47

Royal Dutch-Shell Builds Chemical Plants ..... 49

Tide Water Associated—An American Saga ..... 50

Effect of Underwater Surveys on Marine Life ..... 56

Ohio Oil Inaugurates Refinery Expansion ..... 58

Russian Progress in Underground Gasification of Coal ..... 60

Lion Adds TCC Unit to Refinery ..... 62

Pioneer in Oil Cracking Honored ..... 64

International Notes ..... 66

Oil Company Changes ..... 74

THIS MONTH'S COVER: Mirrored in the froth-covered oil sump is the crown-block of an adjacent derrick.

. . . . OF COURSE THEY ARE
DISCUSSING THE FEATURES OF
DIKKERS OIL VALVES

★

# DIKKERS

HENGELO HOLLAND

*Valve makers since 1879*

# EDITORIAL

## OIL INDUSTRY FACES NEW PROBLEMS

OUTSTANDING attainments must be credited to the oil industry in the year now drawing to a close. In spite of difficulties in obtaining steel and other materials, more wells have been drilled with a greater amount of footage than ever before. Past records of crude production have been broken repeatedly with a daily average above five million barrels for the year. Refinery runs are ten percent above 1946. A vast program of expansion and new construction, involving capital expenditures of four thousand million dollars in the next two years has been put under way.

It is a proud record and one in which the American oil industry may justly take satisfaction. Yet there is definitely to be felt among any gathering of oil men a strong undercurrent of concern, a state of anxiety for the near future and a realization of difficult problems lying close ahead.

Present problems in many ways are more complicated than those that have confronted the oil fraternity heretofore, even during the hectic days of war. The industry is engaged in a stern chase to keep up with the unprecedented expansion in demand for its products. The gain of six percent forecast at the beginning of the year is turning out to be of the order of ten percent. Current estimates are that total demand in the United States during the final quarter of this year and throughout 1948 will be well above six million barrels daily. Some producers and refiners are inclined to complain of what they refer to as runaway demand. What they really are witnessing is a fundamental change in power and fuel requirements that assigns to petroleum a place of ever-growing importance in American economy, a trend that will change only if there is a disastrous drop in industrial activity.

While producers and refiners are striving manfully to keep pace with the swift ascent in market requirements, physical limitations in obtaining material and equipment defer the installation of necessary facilities. None of the numerous pipelines needed to move crude to refineries and products to areas where supplies have been short can be completed before late 1948. New refinery construction to add 400,000 barrels daily to throughput is projected for the next two years, but this will scarcely handle the current rate of growth in overall demand. Adaptations must be made also to meet changes in the relative market positions of products. As is shown in the discussion of the fuel oil situation on other pages of this issue, installations of oil-burning equipment are expanding at a rate that will presently outrun the practicable limits upon the yield of light distillates in refineries as now constituted.

Aside from the purely domestic problems of the American oil industry is the inescapable fact that it is becoming closely involved in international developments. The United States is embarking upon a stupendous program in support of the economic recovery of war-stricken nations on both sides of the world. Part of this gigantic undertaking, relating to the industrial restoration of sixteen European nations, has been reduced to a definite plan which is now before Congress for consideration. Oil is obviously a basic factor in enabling these and other countries to return to a self-maintaining position, and the plan that has been drawn up calls for imports up to 1951 from dollar areas of 865 million barrels with a value of 4,461 million dollars. It also provides for delivery during the same period to three countries—the United Kingdom, France and Western Germany—of petroleum industry equipment valued at over $550 millions, aside from possible commitments elsewhere in the world.

Obviously it will not be possible for the United States to supply anything like the quantity of petroleum products contemplated, and indeed the framers of the plan recognize this for they suggest that a large part of it may be obtained from other areas in which Americans hold concessions. To make this possible, however, it will be necessary for the United States to supply drilling, pipeline and refining equipment for the development of production in these concessionary areas. As for the hundreds of millions of dollars worth of equipment needed for the Marshall plan countries, the authors of the plan observe that a large part of this undoubtedly can be provided by American manufacturers. It undoubtedly is true, as Burt E. Hull recently stated, that a ton of steel put to use in the Middle East would bring to world markets ten to twenty times the amount of oil that would come from its employment in the United States. Sharp protests have been made to Washington, however, against the exportation of any steel or equipment until internal needs have been fully met.

These are but examples of quandaries in which the oil industry inevitably will be involved. They foretell a year of difficult and perhaps fateful decisions lying just ahead.

# ERP MAKES HEAVY DEMANDS ON U. S. OIL AND EQUIPMENT

WILL Americans be required to lower their consumption of petroleum products if European needs for oil and equipment, as outlined by the Committee for European Economic Cooperation, are to be met in the next four years?

Is the CEEC, speaking for the 16 nations to be aided by the European Recovery Program—the so-called Marshall Plan—asking for more oil and petroleum equipment than this country can provide without endangering its own economy?

These questions are being asked by representatives of industry and government as the special session of Congress debates the Administration's $597,000,000 stopgap aid bill for France, Italy and Austria, while the long-range ERP awaits action by the next regular session. The answers, of course, are in the future. Current opinions vary; some are optimistic and others pessimistic, and those who see a distinct threat to the domestic industry are not without support in governmental circles.

Representative Herter (Rep., Mass.), chairman of a committee which studied relief needs in Europe, warns of "heavy and perhaps intolerable" sacrifices ahead for Americans if ERP petroleum schedules are to be met. The Herter report said that if export demand for gasoline, gas oil, kerosene and residual fuel oil continue at present levels in the next six months, "it is doubtful whether civilians could go through this period without a considerable reduction in the consumption of these products."

Commerce Secretary W. Averell Harriman, in the report of the President's Committee on Foreign Aid, takes a less gloomy view. He says the United States can meet requirements for the stopgap period without seriously straining its economy. However, the outlook for the longer period is not rosy according to the Harriman committee report, which says: "It is extremely unlikely that the European petroleum requirements as indicated in the CEEC report can be met in full within the period 1948-51."

Interior Secretary J. A. Krug, reporting on Natural Resources and Foreign Aid, says America has the physical resources to operate a Marshall plan, if handled with care. Even so, he takes a rather dim attitude regarding petroleum, saying: "The primary need for rebuilding Europe's petroleum economy is transportation capacity to carry Middle East oil to European markets. It is uncertain whether or not supplies from domestic resources can be increased over the five-year period to keep up with the domestic demand."

A Washington spokesman for a large segment of the domestic industry fears that American operations will suffer if European requirements are met. He points out that in a study of the European requirements for oil equipment and their effects upon the petroleum economy in the United States, "It is obvious that these requirements in case of certain items would have severe repercussions on the American industry. For example, the program for 1948 for the United Kingdom and Netherlands alone includes 75,000 tons of casing and drill pipe. This quantity for these countries is equivalent to more than 40 percent of total exports of casing, drill pipe and oil pipe from the U. S. in 1946."

It is made clear in the several committee reports and in discussions thereof that all figures for relief are merely goals, dependent on this country's ability to spare them.

European petroleum requirements are set forth in detail in two voluminous reports filed by the Committee for European Economic Cooperation. This committee is headed by Ernest Bevin of Great Britain and represents the United Kingdom, Austria, Belgium, Denmark, France, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Sweden, Switzerland and Turkey, together with Western Germany.

A striking feature of the CEEC report is the stress that is placed upon large-scale substitution of fuel oil for coal and for increased mechanization of agriculture, with resultant increases in consumption of petroleum, in the 16 countries. In view of these factors and taking into account the diversion of Romanian oil, "import requirements from overseas will rise rapidly," says the report. As outlined in the CEEC report, here is the production program as planned by the participating countries in 1948-1951:

(1) Continue efforts to increase production at home and in dependent overseas territories.
(2) Develop oil production in overseas concessions outside dependent territories.
(3) Develop refining capacity at home with a view to economizing in dollar currency, providing raw materials for increasing imported chemicals from oil industries, and working up at the main centers of construction the increased oil output of the Middle East for which sufficient refining capacity is not at present available.

Needs of the 16 countries (exclusive of territories) over the four-year period and the sources (but not origins) of the supplies from which they will be met are indicated in millions of metric tons as follows:

| | 1939 | 1947 | 1948 | 1949 | 1950 | 1951 |
|---|---|---|---|---|---|---|
| Indigenous production | 2.2 | 1.8 | 2.5 | 2.6 | 2.5 | 2.5 |
| Prod. from imported crude | 11.5 | 10.2 | 13.2 | 16.2 | 21.1 | 28.2 |
| Available supplies refined products | 13.7 | 12.0 | 15.7 | 18.8 | 23.6 | 30.7 |
| Requirements of refined products | 33.3 | 43.1 | 53.0 | 59.1 | 64.6 | 68.7 |
| Import requirements refined products | 19.6 | 31.1 | 37.3 | 40.3 | 41.0 | 38.0 |
| Import requirements of overseas dependencies | 2.9 | 4.4 | 6.6 | 7.5 | 8.1 | 8.1 |

The total increase of requirements in 1951 as compared with 1947 is 25.6 million tons, an increase of 59 percent, made up as regards principal products as follows: motor gasoline, 3.4 million tons, 33 percent; kerosene, 0.5 and 14 percent; gas/diesel oil, 2.9 and 32 percent; and fuel oil, 16.8 and 106 percent.

The CEEC report continues: "The relatively moderate increase in motor gasoline needs is based on assumption that consumption for non-essential purposes will continue to be restricted; the additional supplies are required mainly to meet growing demands of road transport services and agriculture. By far the greatest increase will be in fuel oil for industrial and shipping purposes. Any shortage of fuel oil as compared with estimates will automatically either reduce economic activity or lead to increased requirement of coal. These figures show the impact of new refinery construction programs, as over the period (1951 as compared with 1947,) imports by participating countries (except territories) will in case of crude oil increase by 179 percent; in case of refined products they will increase by only 22 percent."

The CEEC report further says, "Due to the United States becoming a net importer of oil, it will not be easy to cover the rising needs of the participating countries. The strenuous efforts which are being made by American and non-American producers to increase production in overseas areas should, however, yield substantial results within a relatively short time. It has, therefore, been considered reasonable to assume

that the oil program will be met."

The 1948-51 refinery and production equipment needs are placed at $1,848 millions, of which no less than $1,260 millions in value or 68 percent can be produced by the participating countries.

The consumption requirements of petroleum products and the equipment programs—principally for the development of oil-producing areas and building of refineries at home and abroad—involve the following imports from non-dollar and dollar sources, the latter including dollar oil from areas outside North America:

**Estimated Volume of Total Imports (Millions of U. S. Dollars)**

| | 1948 | 1949 | 1950 | 1951 | Total 1948 to 1951 Dollar Supplies | Total 1948 to 1951 Non-Dollar Supplies |
|---|---|---|---|---|---|---|
| Crude oils | 191 | 245 | 308 | 415 | 584 | 575 |
| Refined products | 861 | 912 | 935 | 848 | 1,603 | 1,933 |
| Equipment | 449 | 452 | 442 | 472 | 555 | 1,260 |
| Totals | 1,501 | 1,609 | 1,685 | 1,735 | 2,742 | 3,788 |

It is explained that the basic assumption which was made in preparing the split between dollar and non-dollar oil is that the proportions of the two will remain relatively constant over the period and in line with the present position.

Slow recovery in the rest of the world will increase the pressure upon American sources, the CEEC agrees, saying: "The effect of this is that the participating countries must necessarily seek to develop larger import programs from the American continent than they would have done normally." The program involves the importation into the United States of oil valued at $500 million in 1948, rising to $550 million in 1951, a total of $2,200 million in the four years.

Petroleum is one of the largest items; a heavy increase in consumption is expected and total requirements of participating countries and their overseas territories are expected to rise from 48,000,000 tons in 1947 to 77,000,000 in 1951. The expansion of petroleum consumption will bring consumption per head up to only about 15 percent of that now ruling in the United States, the CEEC says.

"Rather important," says the committee, "are the types of equipment and machinery in which the United States specializes. Of these items, petroleum equipment and steel plant will remain relatively constant at $300 millions a year throughout the period."

This program is designed to achieve by 1951 the development of oil refining capacity in terms of crude oil throughput by 17 million tons to two and one half times the prewar level.

In conclusion the committee report said, in part: "The program is based upon the fullest use of their (the participating countries') existing production capacity. In drawing it up, they have sought to reduce their needs from the American continent to the minimum consistent with its achievement. The American people, through their government and their Congress, will consider the program to determine whether the means can be found of supplying those needs. On their decision will depend whether Europe can achieve economic stability and thereby be enabled to make her full contribution to the welfare of the world."

While presidential advisers and committees seem in agreement that this country has the physical resources to operate the ERP with some modifications and a few controls here and there, it is certain that Congress will take a long and searching look at the nation's oil resources before committing the United States to the long-range program. The reports of the Harriman, Krug and Herter committees will be given careful scrutiny, along with other reports that may be submitted to Congress by petroleum industry groups, both independent and major company interests.

Prospects that the United States will meet all European requirements for petroleum and petroleum equipment, as set up in the CEEC report, are particularly dim for the long term. The Harriman committee agrees with this, saying: "There is little likelihood that these requirements set forth (by the CEEC) at Paris can be met."

The Harriman group, looking to the years beyond calendar 1948, emphasizes that estimates are altogether speculative; that any aid extended to Europe must be on a year-to-year basis. Their report points out that, next to coal, petroleum is the most important source of energy for the European recovery program; it observes that the CEEC has outlined petroleum requirements for participating countries, estimating needs in 1948 at 59,542,000 tons as compared with 36,224,000 tons in 1938; that by 1951 requirements are expected to rise to nearly 77,000,000 tons; that bulk of requirements must be imported from non-participating countries; that approximately 45 percent of total requirements must be secured from dollar sources (American companies); that based on July, 1947, f.o.b. prices, the total value of oil from dollar sources is $2,460,838,000 over the four-year period.

This program has little chance of being met in full, observes the committee. However, it says that with large expansion of the Middle Eastern fields and corresponding expansion of refining capacity and transportation facilities, the expectation is that these developments ultimately will make possible the fulfillment of the European petroleum requirements, but with a lag of at least one or two years behind the rate projected by the CEEC.

Nor is there much likelihood that European requirements for petroleum equipment can be met in full. The total volume of petroleum equipment required from 1948 to 1951 by oil companies owned by CEEC nationals and operating within CEEC countries and elsewhere is $1.9 billions. This estimate does not include the requirements of United States owned companies, even within the CEEC countries. It is expected that the CEEC countries will produce $1.3 billions of the total, leaving balance of almost $600 millions of equipment to be supplied by the United States. This leads the Harriman group to the conclusion that it is probable that the total equipment requirements, plus projected expansion of petroleum capacities by other countries including the United States, exceed world capacity to produce petroleum equipment.

**Imports of Equipment from the American Continent (Millions of U. S. Dollars at July 1, 1947 price)**

| | 1948 | 1949 | 1950 | 1951 | Total 1948-51 |
|---|---|---|---|---|---|
| Petroleum equipment to create new capacity or restore or replace domestic cap. | 50 | 51 | 52 | 49 | 202 |
| Other petroleum equipment | 118 | 96 | 64 | 75 | 353 |

**Estimated Cost of Specialized Oil Equipment Required from United States (Millions of U. S. Dollars)**

| Year | For Use in Participating Countries | For Use in Dep. Overseas Terr. | For Use by participating countries in other regions | Total |
|---|---|---|---|---|
| 1948 | 104.4 | 7.5 | 63.1 | 175.0 |
| 1949 | 84.7 | 8.0 | 62.8 | 155.5 |
| 1950 | 61.0 | 8.5 | 54.7 | 124.2 |
| 1951 | 59.3 | 9.3 | 64.9 | 133.5 |
| Total | 309.4 | 33.3 | 245.5 | 588.2 |

"Thus it is extremely unlikely that the United States can export as much equipment as is expected," the Harriman report says. "However, in light of the importance of petroleum equipment to the ERP, every effort should be made to extend a maximum amount of aid as long as the requirements of the American petroleum industry are not seriously prejudiced thereby."

A somewhat special problem is presented by tankers, the position here being one of prospective world shortage rather than surplus. Also it generally is recognized that the great bulk of Europe's required petroleum imports, most of which will come from the Eastern hemisphere in future, will and should be carried in foreign flag vessels. Hence, the Harriman group says it is appropriate to transfer to foreign flag any surplus United States tankers which are not required for our own import programs, insofar as this can be done without jeopardizing national defense.

The committee also recommends the construction in American yards of some new, large, fast tankers for American oil companies to ease the prospective tanker shortage and to strengthen the American fleet available for defense. These tankers, says the committee, should be designed

*(Continued on page 86)*

# EIGHT PERCENT OF CALIFORNIA CRUDE

By L. P. Stockman

STATUS of the California tideland situation becomes more obscure with each successive ruling of the U. S. Supreme Court and the legal tangle resulting from the Court's rulings will take years to unravel unless Congress steps in and decides the issue. California officials, who characterize the present status as "A confused, complicated situation," have consistently maintained that ownership of the tidelands should be decided by political action and is not a matter for judicial adjudication. The Supreme Court indirectly upheld this contention in its initial decision which held that the tideland situation was a matter requiring Congressional action and then proceeded to uphold the Government's claim to "paramount federal rights in and full dominion over" without deciding ownership of the lands in question. The California Attorney General has consistently maintained that the Court's decision was not only contrary to precedent but established a precedent for unpredictable future confiscation of private property on a vague concept of national power.

The California tideland decision is of more importance than appears on the surface because it can be applied equally as effectively to Texas, Louisiana, Florida, Mississippi and other coastal states on the concept that the Government has paramount federal rights which supersede all others. The Attorney General was recently quoted as having said, "I am not saying we are not going to bring other suits," which may mean the possibility of similar action in other areas and regions. Beaufort Jester, Governor of Texas, and Price Daniel, Texas Attorney General, are awake to the implications and have assumed an aggressive attitude. The present decision also affects future status of the Continental Shelf of the United States which may contain as much oil and gas as has been produced from terra firma to date.

California operators feel that Congress, in fairness, must ultimately enact legislation, in one form or another, granting the respective states control over tidelands and submerged land beneath rivers and harbors because in other states

The Elwood field has 73 tideland wells.

# PRODUCED FROM TIDELANDS

mining activities present a somewhat similar situation, thus broadening the scope of possible future application of the Court's decision. The Governor's Conference, held at Salt Lake July 16, and the National Association of Attorneys General have gone on record as advocating the quitclaiming of tidelands to the respective states. Actually, the House of Representatives passed such a bill in 1945 and the Senate approved the measure in 1946 but President Truman vetoed the act in August, 1946. In any event it is quite likely that present tideland operators will be protected and permitted to produce in conformity with existing leases. The Interior Department recently denied leases to a large number of prospective operators who had filed secondary applications for federal leases on currently productive tidelands because the Attorney General ruled that provisions of the existing Mineral Leasing Act of 1920 did not apply to tidelands.

The present tideland situation began in October, 1945, when the U. S. Attorney General filed suit against the State of California to quiet title to submerged lands and the resulting subsequent decisions of the U. S. Supreme Court in June, 1947, has confused the real issue. Previously, on May 29, 1945, the Attorney General filed a test case against Pacific Western Oil Co. involving 144.07 acres of productive tideland in the Elwood field of Santa Barbara County, but this was later dismissed when it became apparent that the Attorney General would, if successful, have to proceed against each single operator. The suit against the State of California was started at the instigation of U. S. Attorney General Biddle who alleged that 2,100 acres of government tidelands, containing 73,500,000 barrels of oil, were being illegally exploited and converted to private ownership.

It had been known for several months prior to the filing of Government's suit that the Attorney General would claim title to the marginal sea as a result of the treaty with Mexico in 1948 and contemplated early action. As a result of this concept, the Mexican Government has made claim to Catalina Island and other adjacent islands lying along the California coast because they were not specifically mentioned in the treaty. This claim was made within the 100 year period as required by international law. The California Legislature on March 16, 1945, issued its celebrated Manifesto of 1945 previous to the Government's announced intention of proceeding with litigation. The Manifesto, among other things proclaimed and announced in unequivocal language that California, "As a sovereign commonwealth always had, does now and forever shall own its tidelands, submerged lands, the beds of its lakes and navigable streams and the fauna and flora and minerals therein and thereunder."

The tidelands were first tapped by prospectors in 1930-31 by wells located on the uplands. These wells were directed out beyond the low tide line by tilting the rotary table and proved successful in developing large production. The technique of directional drilling, which is now used exclusively in tideland development, has been advanced and perfected in the intervening years and is too well known to require comment. Previously, several wells drilled by Standard Oil Co. on the upland inside the tide line were surveyed and found to have drifted a relatively few feet outside the low tide line beneath the tidelands. These wells, following the line of least resistance, drifted down structure.

In order to clarify a general misconception, it might not be amiss to call attention to the fact that most of the tideland leases are held by independent operators whose aggressive development work has been primarily responsible for the importance of tideland production. Data presented below will prove the accuracy of this statement. By 1933, a number of wells had been whipstocked or otherwise deviated from the vertical and bottomed in the tidelands. The State of California accordingly filed suits against all operators alleging illegal trespass but the litigation did not come to a final conclusion as the suits were settled, following decision of a California Superior Court, and a decision was agreed to on November 15, 1934, at which time the State issued tideland leases. All wells were surveyed and all back royalties were paid into the State treasury.

Tideland development produces a revenue to the State of approximately $5,000,000 annually. This is expended as follows: $250,000 annually for administrative expenses of the State Land Office; the next $150,000 to the Veterans Educational Fund; 30 percent to the State general fund; 23⅓ percent to the State Beach Fund and 46⅔ percent to the State Park Fund. Amounts allocated to the Beach and Park funds are expended for the acquisition and maintenance of ocean beaches and parks and are thus expended in the public interest. In conformity with stipulations between the U. S. Attorney General, Secretary of Interior Krug and the California Attorney General, revenues accruing since the Supreme Court decision in June are being impounded by the State pending outcome of the issue. Operators continue drilling and producing activities and make payment as heretofore and at the same rate of percentage. Original tideland leases extended for a distance of one mile out beyond the low tide line but in recent years it has been deemed advisable to extend the seaward distance to three miles. This enables operators to go out farther, take a greater penetration into the oil zone and increase recovery.

California tideland leases, which are affected by the involved tideland litigation, are producing approximately 35,000 barrels daily from 79 leases at Rincon, Elwood, Capitan and Huntington Beach, comprising a total of 6,291 acres. A number of other leases have been made, usually after competitive bidding, the one lease at Goleta gas field in Santa Barbara County has been unitized and returns a percentage of gas revenues to the State. Tideland development in the Wilmington field, which has resulted in a production of 37,500 barrels daily, is not affected by present tideland oil if and when exploited. Productive contours in the Torrance field indicate the probable existence of tideland production out in the ocean opposite the town of Redondo but drilling restrictions appear to preclude future development. No State leases have been awarded in this area.

A well completed March 26, 1944, in the north El Segundo area by E. W. and Harold Pauley in the so-called Hyperion Sewer Farm district suggests the probable existence of an off shore accumulation at this point. Joint exploratory work to the northeast failed to conform with expectations and to date only two wells have been officially completed. The Pauley test, which found small production in the schist-conglomerate, is located so close to the ocean front that it is logical to assume that a tideland accumulation exists in this locality. Because there is no drainage of any magnitude, a prerequisite for State action, no leases have been awarded in this district.

Part of the Venice-Playa Del Rey oil field undoubtedly extends beneath the tidelands in that region but no award has been made due to the inability to secure surface rights and authority to cross private property has prevented the drilling of a test well. In some areas private beaches exist from the upland to low tide and permission would have to be secured before such private property could be crossed. A group of wells within throwing distance of the surf at Venice appears to be tangible evidence that at least a portion of the field extends out into the open ocean. This field is badly depleted, however, and it is questionable whether exploratory work at this time would justify the expenditure necessary.

Recent development work in the Montalvo district of Ventura County also suggests the possible existence of another tideland accumulation although very little is known about existing structural conditions because of limited development to date. No tideland leases have been awarded

in this district to date but this will ultimately be done if future drilling operations indicate the probable existence of production in the tideland area. This will be done by competitive bidding. The Hollister Ranch area presents some possibilities but this is wildcat territory and is not proved up by any means. Carpinteria, in Santa Barbara County is in a somewhat similar position but is considered as having some merit. Gaviota is another potential tideland but this district, too, is wildcat territory. A discovery of undetermined importance has recently been made in the Goleta-Coal Oil Point district of Santa Barbara County but its significance should be known soon as a second well is already on the way down. This tideland exploration has been under way for about a year and the most recent test looked quite good until water broke in and prevented a conclusive test.

The last of the group of areas containing potential tideland accumulations is one of the oldest fields in the State and is believed to have been the first field where production was secured out beyond the tide line. This is the Summerland field of Santa Barbara County where the first well was drilled in 1886 on the upland by H. L. Williams on Ortega Hill at an elevation of 250 feet above sea level. These were shallow wells, ranging around 400 feet, and as drilling progressed the wells moved closer to the ocean front. As a logical development, several drilling piers were constructed and numerous wells were drilled from the long piers, one of which was 1,230 feet long. Active development work stopped about 1900 and gradually the wells and piers were wrecked by wind and tides until today there is very little left. This area is considered as having promise with deeper drilling but there is no unanimity of opinion regarding the age of the formation present although a well, drilled by George F. Getty, is believed to have secured a major penetration into the Sespe of Miocene age.

### Rincon

The Rincon field, located at the extreme western end of the major Ventura Avenue anticline where it plunges into the Pacific Ocean, was discovered by Pan American Petroleum Co. on December 24, 1927, and, like in other fields located close to the tidelands, operators were quick to surmise that a portion of the productive measures would be found out beyond the low tide line. This proved correct and within a relatively short time tideland development was undertaken by the construction of several drilling piers. As matter of fact the highest structural point of the Rincon anticline is located offshore and the most westerly part of the productive sand may not have been reached by directionally drilled holes. Six tideland leases, aggregating 1,323 acres are outstanding at Rincon and a total of 42 wells are producing 2,125 barrels daily. There was at one time a steel and concrete island from which three wells were drilled offshore at Rincon but all wells have now been abandoned and the base unused. All materials used in the construction of this drilling island were barged to the location from Los Angeles Harbor as, due to the highly competitive struggle for production, access from the uplands was denied the operator.

Operators, wells, production and numbers of Rincon tideland leases follow:

| Operator | Lease No. | No. of Wells | Production B/D |
|---|---|---|---|
| Fullerton Oil Co. | 144-145 | 4 | 300 |
| General Pet. Corp. | 48 | 22 | 1,295 |
| Honolulu Oil Corp. | 56 | 4 | 300 |
| Needham, N. C. | 55 | 1 | 25 |
| Richfield Oil Corp. | 52 | 11 | 295 |
| Total | 6 | 42 | 2,215 |

### Elwood

The Elwood field, located about ten miles west of Santa Barbara, was discovered by a joint well of Barnsdall and Rio Grande Oil Co. on June 26, 1928, and subsequent development resulted in construction of sixteen drilling piers and prosecution of tideland exploitation. A Jap submarine fired a couple of shots at the shore installations in this field during the war period but failed to do any material damage and production activities continued uninterrupted. There are nine tideland leases covering a total of 2,899 acres in effect at Elwood and there are 73 wells producing 7,025 barrels per day from the tideland accumulation. All but a very small part of the producing wells in the Elwood tidelands were drilled immediately following discovery of the field and the apparent disproportionate amount of production of Signal Oil & Gas Co. is due to the fact that this company has done considerable extension work west of the original field. Signal has been successful in completing several excellent wells on State leases 129 and 208 in recent months and has found commercial production at the extreme western end of the Elwood field. Unfortunately, there is not enough natural gas left in the reservoir to sustain large flowing wells but porosities and permeabilities are high and good production is being secured. Development work is continuing and additional completions may be anticipated. The tideland accumulation is being exploited by Signal Oil & Gas Co. by means of directional drilling. Signal undertook its extension work several years after completion of the field's primary development and may have found a nubbin at the west end of the Elwood structure.

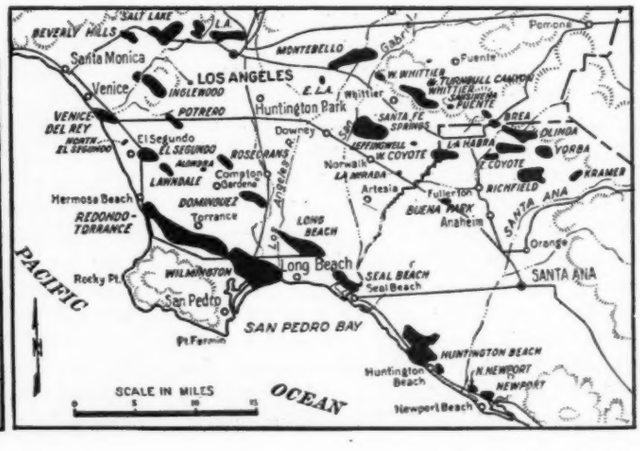
Operators, wells and daily production of the Elwood tideland pool follow:

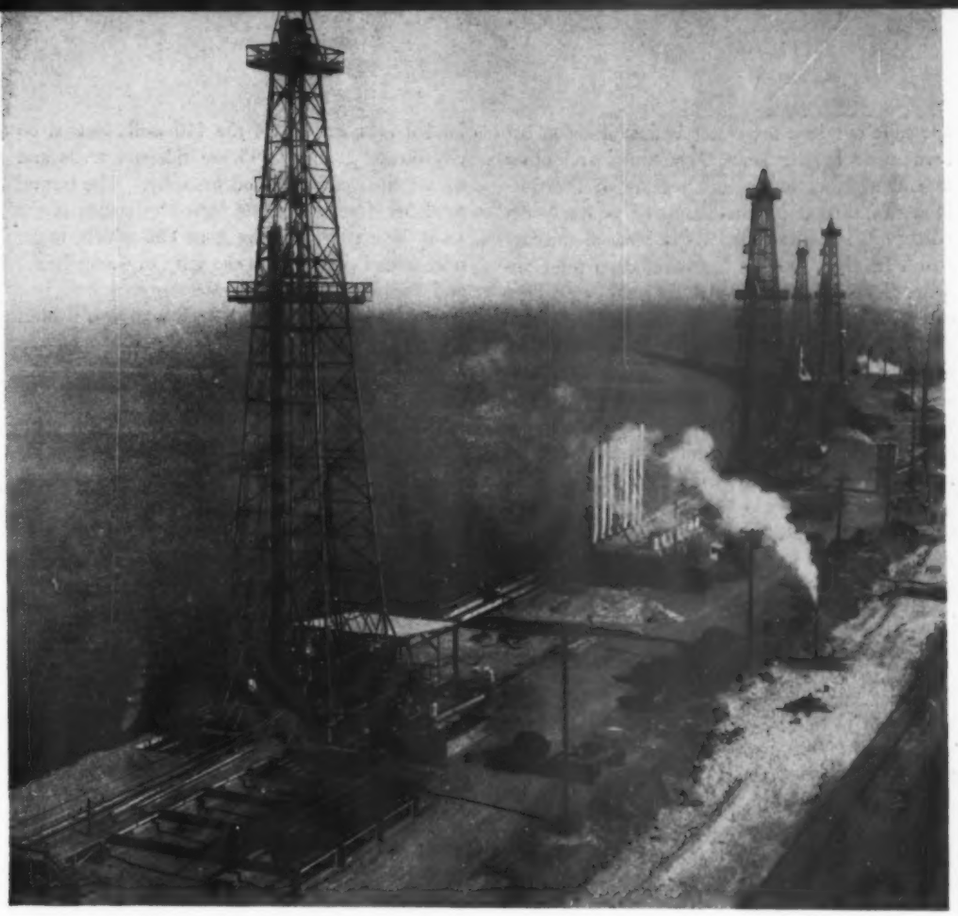
| Operator | Lease No. | No. of Wells | Production B/D |
|---|---|---|---|
| Bankline Oil Co. | 89 | 9 | 140 |
| Barnsdall-Richfield | 88 | 10 | 85 |
| Honolulu Oil Corp. | 90 | 5 | 20 |
| Pacific Western | 92-93 | 15 | 950 |
| Signal O. & G. Co. | 91-98 | 13 | 2,155 |
| Signal O. & G. Co. | 129-208 | 21 | 3,675 |
| | 9 | 73 | 7,025 |

### Huntington Beach

A total of 63 tideland leases and easements have been awarded to operators at Huntington Beach and 216 tideland wells have been drilled to date on a total of 2,064 acres. Two productive zones, the main sand and the upper, or Jones sand, have been exploited. The initial tideland development program involved the lower or so-called main sand and later active development was undertaken of the Jones sand. The situation in this field is somewhat different from most other

Maps of Elwood-Rincon and Los Angeles Basin fields showing principal tideland producing areas.





Richfield development at South Wilmington field.

fields where specific leases were awarded because a number of wells had been drilled before the State secured control of the tidelands and started issuing tideland leases. This accounts for easements in this field which are absent in other producing areas where tideland development took place after the State began issuing tideland leases. The Huntington State Co. second largest producer in the Huntington Beach tideland accumulation is owned jointly on a 50/50 basis by Signal Oil & Gas Co. and Hancock Oil Co. independent operators. Southwest Exploration Co., largest producer in the tideland pools is likewise independently owned.

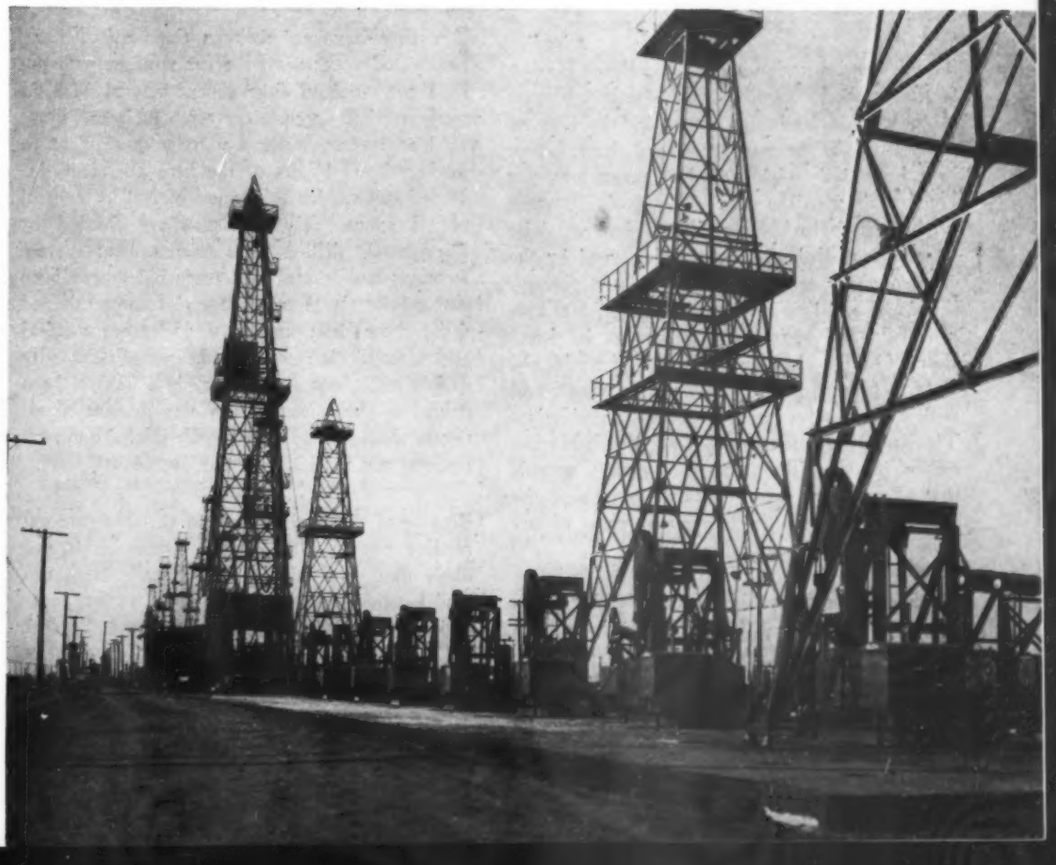
The following operators are producing from the tideland accumulation at Huntington Beach:

| Name of Operator | No. of Wells | Production B/D |
|---|---|---|
| Beloil Corp. | 3 | 60 |
| Benito Huntington Oil Co. | 1 | 25 |
| Charles W. Camp | 1 | 20 |
| Eagle O. & R. Co. | 3 | 120 |
| Hamilton & Sherman | 1 | 240 |
| Hammil Oil Corp. | 1 | 50 |
| H. B. Oil Co. | 1 | 25 |
| Howard & Co. | 1 | 25 |
| Huntington Signal Oil Co. | 1 | 25 |
| Huntington State Co. | 23 | 2,750 |
| Lido Petroleum Co. | 1 | 100 |
| J. H. Marion | 3 | 150 |
| Mar Rico Oil Co. | 1 | 205 |
| McVicar & Rood | 6 | 810 |
| M. & H. Oil Corp. | 1 | 145 |
| Milton Oil Corp. | 1 | 45 |
| Minnesota Oil Co. | 1 | 30 |
| Ocean Front Oil Co. | 1 | 50 |
| O. D. Oil Co. | 2 | 60 |
| Orco Oil Co. | 1 | 160 |
| Petrol Corp. | 3 | 175 |
| Reading Oil Corp. | 1 | 265 |
| Ruchti Oil Co. | 1 | 160 |
| Signal O. & G. Co. | 11 | 1,085 |
| Milton Silverstone | 1 | 20 |
| Simarco Oil Co. | 2 | 240 |
| Southwest Exploration Co. | 97 | 16,000 |
| Standard Oil Co. | 22 | 200 |
| Surf Associates | 1 | 25 |
| Termo Oil Co. | 6 | 1,200 |
| Tower Petroleum Co. | 1 | 35 |
| West Shore Pet. Co. | 1 | 20 |
| Western States Drlg. Co. | 1 | 100 |
| Wilshire Oil Co. | 13 | 1,275 |
| W. K. Co. | 1 | 30 |
| Total | 216 | 25,925 |

## Seal Beach

One of the most promising semi-proved areas is that located adjacent to the ocean front in the Seal Beach quadrangle in Los Angeles County where Gilco Oil Co. and Marine Exploration Co. have drilled a test out into the tideland and secured some dry gas. This wildcat is reported to have been bottomed approximately 4,000 feet out from the low tide line at a drilled depth of 8,050 feet. Unverified deviations from the vertical are reported to have been 60° at 5,000 feet, 70° at 7,000 feet and 76° at 7,300 feet. The test has the flattest angle of any well drilled into the tidelands up to the present but despite the maximum deflection attained the operators were unable to reach out as far as desired. This wildcat has been redrilled three times due to mechanical trouble and the difficulty experienced by the drilling contractor in keeping within the 25 foot drilling cylinder which predetermined the course of the hole.

The joint test of Gilco and Marine, sponsored by independent operators, which showed an initial of 1,500 mcf of dry gas on an early production test and 2,000 mcf on June 21, 1947, is not being produced commercially. Mechanical trouble developed from time to time and it was not possible to satisfactorily land casing which froze above the objective. Drill pipe was then run in but by this time the diameter of the hole had been reduced to the point where further drilling was impracticable. Reaching the conclusion that the projected tideland pool could not be reached from the upland, the operators asked permission, a short time ago, to erect a drilling island about



Tideland wells at Huntington Beach, California, showing pumping units which, for the most part, are producing oil from Jones sand wells under the ocean.

one mile out into the water but no decision has been made by the War Department and other federal agencies involved. Because of the tideland situation, it is not likely that an early decision will be made especially in view of the fact that President Truman has withdrawn the Continental Shelf from entry. If such an island could be erected, the operators would be able to reach out farther into the tideland and drill one or more directionally drilled holes for a conclusive test. This tideland lease, issued by the State of California, is semi-proved and had showed commercial gas production before the Supreme Court's decision on the tideland situation. These operators should be protected and allowed to proceed with additional exploratory work as they have shown their good faith by spending considerable money in their efforts to produce the Seal Beach accumulation.

### Wilmington-Long Beach

Strange as it may seem, none of the various tideland wells in the Wilmington field are affected on tideland property acquired by the city of Long Beach on a state grant in 1911 in consideration of projected habor development. Validity of this grant has been upheld by the State Supreme Court but at some future date it is possible the federal government might attack this title as was done at Elk Hills a number of years ago. Conditions are somewhat similar, the State having conveyed title to a second party. The federal government in the Elk Hills case, proved the State did not acquire title and therefore could not transfer title to property which it did not own. The City of Long Beach has a capital investment in tideland development of about $8,000,000 and takes delivery of all dry gas produced from city owned property and disposes of it to Long Beach consumers through the municipally owned gas system. The Long Beach tidelands in the Wilmington field extend from the low tide line out for a distance of three miles.

The tideland situation in the Long Beach Harbor section of the Wilmington field is unique because all of the tidelands are owned by the City of Long Beach by the grant mentioned above. Leases have been made with several operators who pay high royalties to the city. A total of 410 wells producing approximately 50,000 barrels daily have been drilled on nine parcels owned by the city and the average royalty exceeds 50 percent. Tideland wells are producing about 37,500 barrels daily and aggressive exploitation by Long Beach Oil Development Co. and Richfield Oil Corp. is producing several new wells weekly and will substantially increase tideland production. Tideland production in the Long Beach Harbor section of the Wilmington field greatly exceeds that of any other field and at the same time the recoverable reserves are larger than those of any other tideland accumulation.

Through its contracts with operators, the city is plowing back about $1,000,000 monthly in tideland development. Of the 410 wells located on city owned acreage, 345 are tideland wells and 65 are situated on upland property. The largest producer from the Long Beach tidelands is the Long Beach Oil Development Co. which, to all intents and purposes, is the City of Long Beach and the most recent contract entered into was with Richfield Oil Corp. which was high bidder. In the Richfield deal, 94.1 percent of production belongs to the City of Long Beach and 5.9 percent belongs to Richfield for administration and overhead expenses. The City's share of 94.1 percent is split into two divisions, 34 percent to cover the cost of development and 60.1 percent as royalty from present production. Upon liquidation of development costs, the entire 94.1 percent is payable to the City treasury.

The Long Beach Harbor Commissioners, with the technical advice of Stanley & Holz, independent consultants, worked out an excellent program, before a single permit was granted, for development of the Long Beach Harbor section of the field and provided for all possible contingencies including the posting of adequate bonds to guarantee fulfillment of contractual obligations and to prevent creation of any objectionable conditions. This statute is still the finest example of cooperation between operators and the municipal government and an outstanding example of good housekeeping in an oil field. This regulatory statute has proved conclusively that oil field development can be carried out under esthetic conditions and under proper supervision.

**Tideland Production**

| Field and county | Wells No. of | B/D Production |
|---|---|---|
| Elwood, Santa Barbara | 73 | 7,025 |
| Huntington Beach, Orange | 216 | 25,925 |
| Rincon, Ventura | 42 | 2,215 |
| Wilmington, Los Angeles | 345 | 37,500 |
| Total | 676 | 72,665 |

The first contracts between the City of Long Beach and operators were for straight hole upland and tideland development started with 12 wells in 1939 opposite the town lot area. These were multi-zone wells, a practice quite common during the early life of the field but since discarded as undesirable because of lack of control of all zones. The tidelands are reached by directionally drilled holes from upland surface locations and several 60° angle holes have been successfully completed. Many of these tideland wells show drift angles of 45° from vertical and, despite the large number of directionally drilled wells, not a single dry hole has yet been drilled in the tidelands. Ninety percent of all future wells will be directionally drilled and new projects are reaching farther out to sea.

Because of the large amount of the structure extending out into the Pacific Ocean, it is not likely that directionally drilled wells from upland locations will be able to reach remote locations on the south plunge of the structure. Several attempts have been made to secure permission to construct a submerged multiple drilling chamber to be reached by a tunnel from the upland area but no decision has been made. This program is mechanically feasible and financially sound and may ultimately be employed to reach the most remote sections of the tideland accumulation. Many feel it is too early to undertake any such work but that eventually it may be used if directionally drilled holes are not able to reach far enough out.

All directional drilling in the Wilmington field is under strict cylinder specifications which require a drilling contractor to keep within a 50 foot radius of a predetermined course and to make surveys at 100 foot intervals or less, as necessary. This was adopted as standard practice in 1939. Drilling contracts also require the removal of all dog-legs which often occur during directional drilling. Electric logging has been standard practice since discovery of the field and consequently correlation work is very accurate. During the early life of the Wilmington field, wells could not be located within 150 feet of each other but this limitation was later changed to permit 25 foot surface spacing and retain the 150 foot subsurface spacing. This is an important factor because of the multiplicity of zones in the Wilmington field which include the Tar, Ranger, upper and lower Terminal, Union Pacific, Ford, 237 zone and the productive conglomerate-schist. These zones range in thickness from 250 feet to 800 feet for the Ford zone but if we combine the upper and lower Terminal zone the thickness will aggregate about 1,100 feet. A high structural well with all eight productive intervals present would be able to produce progressively from 3,750 feet of formation. The amount of sand in each interval ranges from 25 percent in the Ranger to 60 percent in the 237 zone and all sands show high porosities and permeabilities.

In conclusion it may be said that tideland production is an important factor in California and may become of greater importance as time goes by because of a declining tendency in many other areas. Four tideland pools are producing about 8 percent of present State production and two tideland pools, Wilmington and Huntington Beach, contain substantial reserves. The reserves at Elwood and Rincon are of a somewhat smaller magnitude but are neverthless important factors. We may anticipate additional discoveries of tideland pools in areas not now undergoing exploitation and at some future date it may be possible to undertake production activities in areas now restricted. Possibilities of the Continental Shelf remain conjectural both as to entry and productive possibilities. A long range view indicates a strong probability that Congress will enact suitable legislation to either legalize tideland exploitation or return tideland properties to the respective states. The latter course would prove beneficial to both operators and the public interest.

# FUEL OIL POSES LONG-RANGE PROBLEMS

AT last one major oil company began declining new domestic fuel oil customers nearly six months ago. That policy now is universal among both majors and independents and, as a result, there has been considerable discussion of the fuel oil problem in the public press as well as in trade journals and at meetings of oil and burner people. Most of the discussion has tended to the conclusion that the problem is temporary and that all will be rosy in a year or so, when more refinery capacity is available and when more pipelines have been laid and tank cars and tankers built.

The question may well be raised as to whether this view of the fleeting nature of the problem is correct because there are a number of factors which suggest that it may well become chronic. The three elements which come most readily to mind are:

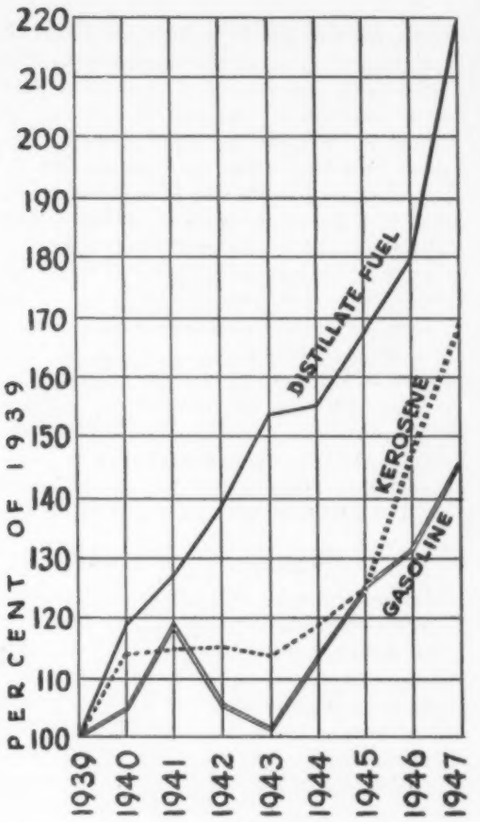
(1) The public desire for automatic heat.
(2) Growing diesel power competition for the available supply of distillate fuels.
(3) The practical limits facing the oil refiner in enlarging his yield of distillates at the expense of residuals and gasoline.

In recent months a survey was conducted among owners of small homes to determine what type of heating plant they want. The number wanting oil was 48 percent, gas, 33 percent, and coal, eight percent. A similar survey conducted only a little over a year ago showed that 44 percent of home owners would like to burn oil, 33 percent gas and 13 percent coal. Within the space of only about one year coal lost about 40 percent of its following among home owners according to these surveys; gas was unchanged, and oil won all of those who want to forsake coal.

The labor situation in the coal industry with its recurrent threat of shortages may have had some part in this change, but most people think that convenience is the real answer. Home owners in the United States all want automatic washing machines that will do everything except hang the clothes on the line. They want mangles to do the ironing, vacuum cleaners to sweep the floor; electric dish washers and even gadgets in the drain to grind up and carry away the garbage. During the war there was a good deal of publicity about the postwar coal furnace which would burn its own soot, feed itself and put its ashes in a dust-proof can or carry them outside through a screw conveyor. There have been some improvements in coal firing, but the fully automatic coal burner is yet to come. Coal demand has shown no substantial increase in the past quarter century, while petroleum demand has risen 500 percent.

Most of the elements going into the construction of the domestic oil burner have been short since VE-Day. Fractional horsepower motors have been particularly scarce. Sheet steel for fuel oil tanks and furnace parts and small diameter piping also have been hard to find. In spite of this shortage, the number of domestic oil burners in use in the United States increased 545,819 in the 18 months from June 1, 1945, to December 31, 1946, according to *Fueloil & Oil Heat Magazine*. This was an increase of 23.7 percent in users in a year and a half.

This past year also has been one of shortages of parts for the oil burner manufacturer. But he managed to produce 801,658 new burners in the first eight months of the year and at the end of August had actually shipped 788,421 central heating type burners to dealers. Reports to the Bureau of Census on that date indicated that burner manufacturers still had on their books unfilled orders for 654,038 burners. In some cases it has been necessary to resort to sheet aluminum instead of steel for fuel oil tanks. The larger burner manufacturers have had to build their own motors, and the small assemblers have been forced to buy from untried manufacturers. Whatever their difficulties, the burner manufacturers have done a magnificent job in seeking to meet the demand for automatic heat.




Demand for distillate fuel oil, diesel fuel and kerosene has been increasing much more rapidly than gasoline in recent years. Demand for each product in 1939 is shown as 100 in the index chart above.

At the end of 1946 there were 2,826,845 domestic conversion burners and integral boiler-burner units operating in the United States, according to *Fueloil & Oil Heat Magazine*. This compares with 1,764,565 gas burners and 1,217,140 coal stokers. The number of oil burners is roughly half of the total number of automatic home heating installations.

The production rate of some 100,000 burners and units per month which was maintained earlier this year will not be possible over any considerable period in which oil companies refuse to sell fuel oil. Stock-piling will be possible for a few months and after that it will be necessary to depend on the replacement market until oil supplies become more plentiful. The winter doesn't look too rosy to burner manufacturers when they reflect that replacement sales last year totaled only 46,000 and have never exceeded about 57,000 in a single year in the past. Some of the larger manufacturers such as Oilomatic and Timken have started to work on replacement sale campaigns.

One reason for the low volume of replacement sales in the past years has been that oil burner

selling has been largely in the hands of fuel oil distributors. The distributor has been more interested in adding new fuel oil customers than in the mere sale of a burner. His attitude, of course, will change under fuel oil proration. Also there have been substantial improvements in many burners since the war so that, particularly with high oil prices, the salesman has a good selling story when he suggests the purchase of a modern burner to save fuel.

The space heater or stove burner manufacturer of appliances burning No. 1 fuel also has been busy since the war. In the first seven months of 1946 oil-burning stove production was 286,073, and this year in the same period it was up to 355,682. There were approximately 3.2 million oil stoves in use on June 30, 1947, and shipments of additional units were running 40,000 per month.

Oil consumption by the central heating plant averages something like 2,000 gallons per year. The oil stove burns about a third as much. An oil burner uses nearly three times as much petroleum as an automobile, and an oil stove nearly 80 percent as much as an automobile. The large consumption per unit is the essential reason why fuel oil demand has been increasing twice as fast as gasoline demand since the close of the war.

A strong competitor for the middle distillate cut from crude oil is the diesel engine. Diesel horsepower installed in stationary plants has been growing at a substantial rate, and the growth of railroad usage is phenomenal. In 1929 United States railroads consumed a half million gallons of diesel fuel. This year railroad demand will be up more than a thousand percent to about 580 million gallons. In 1948 an additional increase of 15 percent to 668 million gallons is anticipated.

Indicated demand for No. 2 domestic fuel and diesel fuel in 1948, without any additional sales of oil burners, will be on the order of 170 million barrels, and the demand for No. 1 fuel for pot type equipment will be about 50 million barrels if no more stoves are sold. These figures do not include kerosene required for the farm or gas oil which competes with No. 2 fuel oil for a share out of the barrel of crude oil.

In 1946 the average yield of kerosene from a barrel of crude was 6.03 percent. The yield of gas oil and domestic fuel oil was about 16 percent, and it has been running about the same this year until the past few weeks when it has been stepped up to about 18 percent. Since the demand for kerosene is so active, any increase in distillate fuel yield will have to come from gasoline and residual fuel.

Distillate fuel prices have risen this year, but not enough to make it economically attractive to produce these oils at the expense of gasoline. Refiners who are increasing their yields are doing so as a matter of service rather than increase profit. Over the long run, however, it seems logical that distillate fuels will have to compete with gasoline and diesel fuel for raw material and pay accordingly.

A rough rule of thumb is that it costs about two cents a convert a gallon of distillate fuel into gasoline. In other words, the refiner who sells No. 2 fuel oil at two cents less than gasoline is operating on a break-even basis as between the two products. It is only when the fuel oil-gasoline differential becomes less than two cents that there is a real incentive to make fuel oil at the expense of gasoline. Currently the margin in Oklahoma is about 1.50 to 1.75 cents per gallon. On the Gulf Coast the cargo price differential between No. 2 and house-brand gasoline is two to 2.25 cents. At New York harbor the differential is about two cents.

In times such as the present when money is free, it would require a very substantial increase to make price act as an effective brake on demand. As a matter of fact oil users are paying very little premium over coal today. In a recent article written for the *New York Journal of Commerce*, Albert J. McIntosh of Socony-Vacuum Oil Company showed that as late as last July, No. 2 fuel oil was cheaper than anthracite coal on a Btu. basis on the East Coast. In eastern areas where bituminous coal is used for home heating, the consumer was paying a premium of 2.5 cents per gallon for the convenience of oil heat. This is a premium of $50 per year on a 2,000 gallon annual consumption, certainly not enough to be effective in discouraging consumption. In the central states Mr. McIntosh found distillate fuel at a disadvantage of 1.33 cents per gallon against coal or only $26.60 per year.

These figures show that the oil industry has not charged the consumer a price commensurate with the luxury which oil provides. During the days of OPA this was due to government control, and a striking evidence of the effect which price can have on refinery yield was seen at the end of 1945 when the OPA finally permitted an increase in No. 2 fuel prices. Although the increase was not large, the yield of distillate fuels jumped from about 14.5 to about 17.5 percent almost overnight.

The modern oil refinery is built to produce a maximum of gasoline, a minimum of residual fuel oil and moderate amounts of kerosene and distillate fuels. Special refineries could be built to increase the distillate fuel yields if the price were high enough. But on the basis of present plant practice, the maximum economic yield is on the order of 20 percent.

At the present rate of increase in demand for distillate fuels, a yield of 20 percent soon will not be enough. This suggests that the present fuel oil problem is not a temporary one as previously stated. The current attempt to solve the problem by proration of oil to dealers and refusal to serve new accounts is at best a makeshift solution which can only be temporary. But some control seems inevitable unless prices are increased to a point at which consumers will see a substantial financial advantage in going back to coal or unless methods are developed of converting coal into liquid or gaseous fuel with the qualities now desired.

The Bettman Archive

# ROYAL DUTCH SHELL BUILDS CHEMICAL PLANTS

SPECIALIZED refineries for the production of chemicals from petroleum are now under construction by the Royal Dutch-Shell Group in Britain and in Holland. Both are expected to reach completion during 1948 and they represent an important expansion in the chemical branch of the European oil industry.

The British plant is located at Thornton-le-Moors.* Construction is under way on the site which covers about 85 acres. The plant will cost several million pounds sterling, is expected to be in production sometime next year and will have an initial output of about 24,000 tons annually.

The process to be used will be based upon the cracking of certain selected petroleum-base materials, at very high temperatures up to 700°C for the production of olefines, mainly ethylenes, propylenes and butylenes. From these will be produced by synthesis or other suitable treatment chemical products including acetone, methylethyl ketone, methyl isobutyl ketone, isopropyl alcohol, diacetone alcohol, secondary and tertiary butyl alcohols, isopropyl ether, and a number of other chemicals, all of which are widely used in many important industries. In addition to the olefines obtained during the cracking process, benzene, toluene and other aromatics will also be produced. In due course these will be used as the starting materials for still further expansion of the range of chemicals manufactured and for synthesizing new chemicals now in the laboratory stage. The range of liquid organic chemicals to be produced at Thornton will be characterized by high actual or latent solvency, low to high boiling ranges, rapid to slow evaporation rate and chemical reactivity. A feature will be their high degree of purity, in most cases exceeding 99 percent.

•

Associated with the Thornton enterprise are developments of existing specialized refineries at Stanlow on the Manchester Ship Canal and at Shell Haven on the Thames Estuary. The Stanlow refinery already produced some 24,000 tons yearly of sodium higher alkyl sulfates by synthesis from higher olefines produced by the vapor phase cracking of petroleum wax.

These sodium higher alkylates are used as detergents and wetting agents in a variety of industrial processes and for domestic purposes as a soap substitute. The technique used in this plant is based upon research carried out in the Shell laboratory in Amsterdam as far back as 1931.

Production at Stanlow was begun during the war, with an initial output of 12,000 tons annually, to enable the replacement of similar products formerly imported almost exclusively from Germany. The erection of this chemicals plant during the war was the first step taken in the manufacture of petroleum chemicals in Great Britain. The construction of additional plant now being carried out is expected to bring the production up to 50,000 tons a year in 1948.

The third development, at Shell Haven, also consists of an extension to the existing specialized refinery. This plant has for some time been manufacturing a range of insecticides, fungicides and other products used in agriculture. The extensions in hand will bring the annual capacity up to 30,000 tons.

An interesting auxiliary to this enlargement of activity is the recent acquisition by the Shell Group of a 170-acre experimental fruit, hop and arable farm at Woodstock, Sittingbourne, Kent. Here agricultural and horticultural research will be concerned with entomology, plant physiology and mycology, and plant helminthology (the study of eel and wire worms), and directed toward the development of the most suitable insecticide sprays, washes and fumigants. At the present time, in particular, this work is of the greatest importance in the economy of Britain's food-production program. These new developments will be on parallel lines in many respects to the work performed in the United States by Shell Chemical Corporation, which owns an expermental farm at Modesto, California, and, in the industrial field, has been prominently engaged for a number of years in research into and in the manufacture and marketing of petroleum-based synthetic chemicals.

Plans are also in hand for an expansion of activities at the Shell research centre, situated at Thornton, an establishment set up just before the war where valuable work was carried out in the wartime development of aviation fuels and lubricants. Following the loss of the Amsterdam laboratories, a laboratory was set up at Thornton which contains, in addition to the normal apparatus of a chemical research laboratory, specialized equipment used in such industries as rubber and plastics, which are actual or potential users of petroleum-based chemicals.

In Holland the Bataafsche Petroleum Mij., the operating company there of the Royal Dutch-Shell Group, is establishing a new chemicals industry. Plans are in hand for erecting two new factories in the immediate neighborhood of the large refinery at Pernis. One of these will be for the manufacture of synthetic resins or plastics and is scheduled to come into operation at the end of 1948 when it will have an initial output of approximately 2,000 tons annually. The product is of vinyl and vinylidene chloride base, and hitherto the Netherlands have had to rely on imports from a broad for this type of material.

The other plant at Pernis, which will also be completed in 1948, will be for the production of detergents and wetting agents or synthetic soaps on the lines of those now being produced at Stanlow in the United Kingdom. This plant will have an initial output of 25,000 tons annually. In this connection the production of crude oil at Schoonebeck now running about 3,800 barrels daily, will be extremely valuable on account of its high content of paraffin wax, which makes it particularly suitable as a base for the production of sodium higher alkyl sulfates.

In addition to the foregoing developments at Pernis, plans are well in hand for the enlargement of the nitrogen factory at Ymuiden operated by the Royal Dutch-Shell affiliate, N. V. Maatschappij tot Exploratie van Koksovengassen (Mekog). Essential parts of the plant's equipment were removed by the Germans and have not yet been recovered. Before the war it had an annual capacity of 16,000 tons of nitrogen. By making temporary arrangements, it was possible since the beginning of 1946 to run the factory at about 50 percent of its capacity. New equipment has in the meantime been purchased and erected, so that the prewar level of production has now almost been attained. Owing to the fertilizer shortage in Holland, the Netherlands government considered the extension of the nitrogen industry as a matter of primary national importance in meeting the world food shortage. Mekog is, therefore, cooperating fully with the government and is increasing the original capacity of the plant up to 51,000 tons per annum. In the new plant, which is expected to be completed by the middle of 1949, calcium-ammoniac nitrate will be manufactured.

The total capital required for this undertaking and the two plants at Pernis will be on the order of 70 million florins ($26,500,000.)

These developments in Great Britain and Holland open a new chapter in the development of the oil industry in Europe and in a very material way will assist in overcoming shortages resulting from the war and thus contributing to recovery.

* See W. P. Annual Refinery Number, July 1947.

Early oil drilling operation at Enterprise, Pennsylvania, believed to be the site of the first commercial oil production by Tide Water in about 1866.

# TIDE WATER ASSOCIATED ...

By B. F. Smith

THOUGH its roots reach back deep into the earliest period of oil history, Tide Water Associated Oil Company in its present form has just attained its majority in the current year. It was established in 1926, twenty-one years ago, through an exchange of stock by which it acquired control of Tide Water Oil Company, operating in the Eastern and Mid-Continent states, and Associated Oil Company, operating in the Pacific Coast area. Although originally a holding corporation, it was changed to a full operating basis in 1936 when the three companies were merged into the Tide Water Associated Oil Company. At the present time its organization is divided into three major units; the Eastern division, the Mid-Continent division and the Western division. Today the company provides a good standard of living for more than 11,000 employees and their families in the United States, has approximately 31,000 shareholders, owns and operates refineries, pipelines, ocean-going and inland tankers, oil wells and much other equipment. In 1946 it realized, principally from the sale of crude oil and petroleum products, gross sales of $216,000,000.

The history of Tide Water Oil Company, now the Eastern and Mid-Continent divisions, dates back to 1865. In that year Byron D. Benson, formerly sheriff of Onondaga County, New York, and Major Robert E. Hopkins, newly discharged from the Union Army, decided to pool their energies and resources in some permanent, constructive type of business venture. These men had been sucessful business partners before the Civil War interrupted their careers. After their release from civil and military duties, they looked over various commercial fields, few of which held encouraging promise for two young men with very slight assets except health, vision and a love of excitement. They began to study a newly-discovered substance which could be extracted from the ground and seemed to have possibilities for lighting the nation's lamps and making its machinery run more smoothly—oil.

Oil had been found seeping out of the ground long before then by the Indians, who used it as a medicine, but it remained for a railroad conductor of New Haven, Conn., "Col." Edwin L. Drake, to obtain it in quantity by drilling the world's first successful oil well near Titusville, Pennsylvania, in 1859. The increasing realization of the useful purposes to which the sluggish dark green fluid could be applied and the consequent smell of money in the air caused a veritable "black-gold" rush to the Pennsylvania hills and fired the imaginations of the two partners, Benson and Hopkins, and their course was set, provided that they could devise means for financing their venture.

Both being experienced lumbermen, they decided to set up a saw mill in the heart of the new oil field and to make it pay for their drilling operations. They named their company the Enter-

prise Oil and Lumber Company. The saw mill project was successful. It brought them the cash needed to construct a crude drilling machine with which they began to bore into the rocky terrain. Their search for the hidden treasure, however, got them nowhere for a long time because their first 17 wells turned out to be dry holes.

Then they struck oil, and the industrial giant which has since become the Tide Water Associated Oil Company, now ranking tenth in domestic production of crude oil, was born. Reflecting the strength of its vigorous parentage, it began to grow and it has been growing ever since.

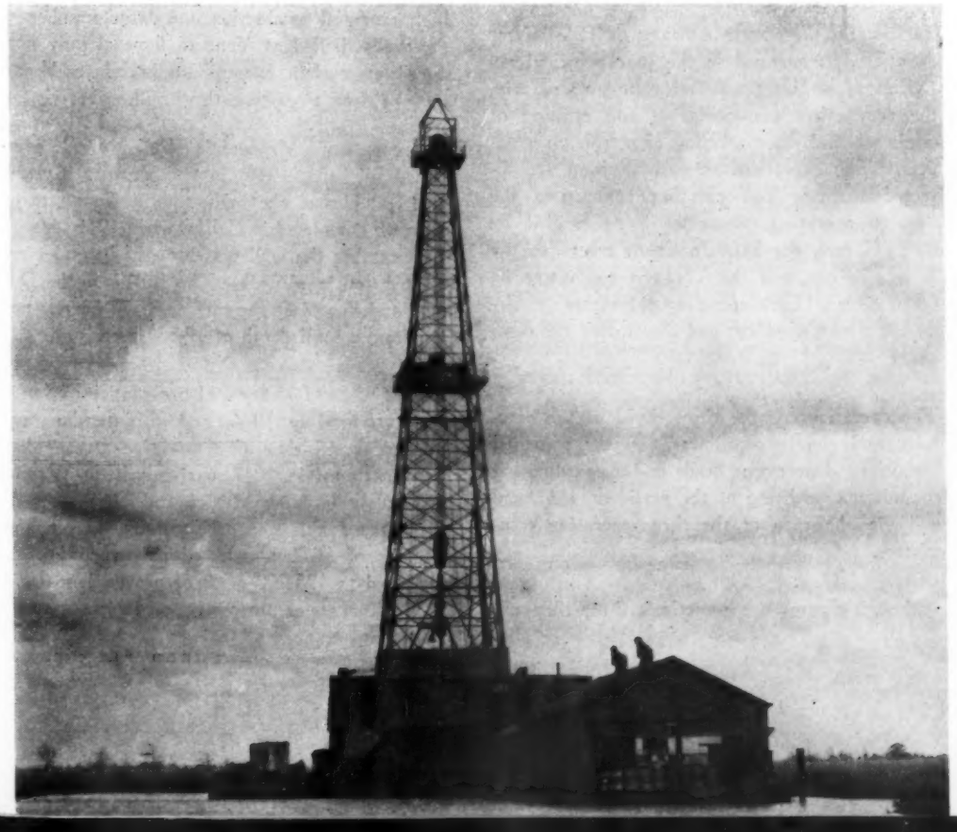
In 1870 the two-man organization received reinforcements in the person of a young lawyer named David McKelvy, and the three went on to new problems and achievements. In those days the budding oil companies of Pennsylvania were having trouble with the local railroads and other purveyors of transportation. Monopolistic practices made it impossible for the producers to get their crude oil to refineries at any sort of a profit. So the three partners made an astonishing decision—to build the world's first oil pipeline over the mountains, across the valleys and under the waters of Newark Bay to a refinery they had acquired in Bayonne, New Jersey. It was a stupendous undertaking, hampered by gory battles with hirelings of opposing forces, heartbreaking delays, lack of materials and breakdown. This building of a pioneer pipeline to deliver crude oil from producing fields in Western Pennsylvania to tide water on the Atlantic Seaboard culminated on the organization on November 22, 1878 of The Tide-Water Pipe Company, Ltd., which was the first corporation bearing a name now included in the present corporate name.

It took ten years for the line to reach the eastern seaboard, but in 1889 Pennsylvania oil, still the world's finest crude, was pouring into the Bayonne refinery, 288 miles away. The story of this first pipeline was such an epic of adventure and business rivalry that in 1936 Paramount Pictures made it into a dramatic and successful motion picture, "High, Wide and Handsome," featuring Irene Dunne, Dorothy Lamour, Randolph Scott and other Hollywood greats.

The rapid growth in the demand for petroleum products in the eastern states soon necessitated a supply of crude oil much greater than could be obtained from the Pennsylvania fields, and in 1905 Tide Water Pipe Company purchased its first lease in Oklahoma. Thereafter producing acreage was acquired in Illinois, Kansas, Texas, Louisiana, New Mexico, Mississippi and Arkansas. In 1909 the pipeline was extended 546 miles westward to tap the promising Illinois fields as well as to connect with lines expected to be laid from the Mid-Continent. By 1913 the Bayonne refinery had increased its runs of crude to 10,000 barrels per day, approximately 4,000 barrels being of Pennsylvania origin and 6,000 barrels from the Illinois and Mid-Continent fields.

# an American Saga

Today's drilling operations are illustrated by this barge in Tide Water's Venice, Louisiana, field.



The desire to control the major portion of the crude supply of the eastern refinery led to a rapid development of the producing end of the business in the Mid-Continent. The steady progress made in this area has been one important reason for the company's financial growth. From a daily average of approximately 10,000 barrels in 1930, production has grown to more than 50,000 barrels of oil and condensate per day. The major portion of this production is obtained in the states of Texas and Louisiana. In the East Texas field the company's holdings total 5,732 acres and 1,065 wells which, under restrictive flow, are permitted a daily allowable production of approximately 14,200 barrels. In the prolific Conroe field, near Houston, the company owns and operates 71 oil wells with a daily allowable production of 5,000 barrels. As a result of its exploratory efforts, several fields were discovered, among them the Venice and West Bay fields, both located at the mouth of the Mississippi River about 90 miles south of New Orleans. The Venice field has proved itself one of the best oil fields in Southern Louisiana, and from its interest in this and the near-by West Bay field, the company is obtaining a daily allowable production of 6,000 barrels from its 37 net wells. In addition the company has substantial production in West Texas and New Mexico, Arkansas, Mississippi, Louisiana and Illinois. The Mid-Continent Division also operates a refinery and sells petroleum products in the Mid-Continent area.

The history of the Western division is curiously akin to that of its eastern counterpart. In 1901 W. S. Porter, an enterprising pipe salesman, persuaded a group of San Joaquin Valley oil men to form an operating group, hoping to sell them pipe for a line that would carry their production from Kern River north to San Francisco Bay. In October, 1901, the group, with Porter as general manager, incorporated as Associated Oil Company. In need of establishing adequate pipeline outlets, Associated Oil Company in 1905 acquired Matson's Pacific Oil and Transportation Company's oil projects, including the Coalinga-Monterey pipeline, a refinery at Gaviota and marine facilities.

In contrast with the difficulties which Tide

Rixford pump station at Rixford, Pennsylvania, on the twin pipe line from western Pennsylvania fields to Tide Water's Bayonne, New Jersey, refinery. This was the world's first long distance oil pipe line.

Water Oil Company had to contend with in its early days, Associated Oil Company received cooperation and valuable finncial aid from the Southern Pacific Railroad Company. In 1909 the Southern Pacific acquired 51 percent of the stock of Associated. In 1920 the railroad formed the Pacific Oil Company to acquire its oil properties and the controlling stock interest in Associated. Pacific Oil owned the majority interest in Associated until 1926 when it sold its oil properties to Standard of California. The Associated stock was not included in this transaction because of the competitive positions of Standard and Associated, but in March, 1926, the newly-organized Tide Water Associated Oil Company acquired control of the long-established Tide Water Oil Company in the East and the Associated Oil Company in the West. It continued as a holding company until the merger in 1936.

In the early years the operations of Associated were confined to production and transportation of crude and the sale of heavy crude as fuel, but in 1913 with the discovery of higher gravity oils in the San Joaquin Valley, refinery operations were initiated at Avon on San Francisco Bay. Until the discovery of the highly productive Los Angeles Basin fields in 1922 and 1923, Associated's net crude production had averaged about 22,000 barrels daily. With these new discoveries crude production was approximately doubled. With its own flush production and current purchases, large volumes of crude were available for shipment to the East Coast and Tide Water became a large purchaser of crude from Associated. This contractual relationship was one of the forerunners of the later association in 1926. Since the depression years of the 30's the Western Division increased net production to 40,000 barrels daily in 1946 and refinery runs from approximately 60,000 barrels daily in 1926 to 93,000 barrels per day in 1946. The volume of gasoline manufactured has increased materially faster than the increase in crude runs due to the successive installation of thermal and catalytic cracking. The Western division gasoline manufacture in 1946 was approximately 30,000 barrels per day as compared to slightly over 11,000 barrels in 1926.

The Tide Water Associated Oil Company is headed by President William F. Humphrey, and many of the officers who were elected at the time of the 1936 merger remain active. President Humphrey, under whose direction the merger and refinancing program were consumated, joined the organization in 1925 as a director of the Associated Oil Company in San Francisco. On August 1, 1926, he was appointed chief counsel and on August 15, 1926, he was elected chairman. He became Associated Oil's president a year later and in May, 1933, also became president of the Tide Water Associated Oil Company.

Each of the three main divisions of Tide Water Associated is engaged in the four principal activities of an integrated oil company; namely, the production, transportation and refining of crude oil, and the marketing of petroleum products. The operations of each division are directed through an operating committee, the Eastern operating committee being headed by B. I. Graves, the Mid-Continent committee by E. H. Salrin, and the Western committee by L. F. Bayer. Each operating committee's chairman is a vice president and director of the company.

The operations of the three divisions are carefully and closely coordinated by the principal executives, department heads and a coordinating committee, consisting of the president, chairmen and vice-chairmen of the three operating committees.

Although figures are sometimes dull, they are useful in telling the story of the growth of a business enterprise or industry. Great progress has been made in the finding, acquisition and development of crude oil preserves. In 1936, Tide Water Associated produced about 20,000,000 barrels of crude from its 3,265 producing oil wells and held over 640,000 acres of developed and undeveloped land in 14 states. In 1946 the company's crude net production totaled 31,438,000 barrels produced from 5,236 wells. It then held 2,275,000 acres of proved and prospective oil lands.

A total of $15,128,000 was expended in 1946 in developing producing properties, acquiring additional acreage and drilling tests. Large sums were also expended in exploratory operations

The Western division has been credited with several discoveries in California and has been particularly successful in finding new deep zones in old fields. The Ventura Avenue field located in Ventura County, California, is probably one of the most remarkable oil fields in America. Tide Water Associated controls approximately 40 percent of its proved area of about 2,200 acres and approximately 3,000 acres of other prospective oil lands adjacent to the proved field. Even after 20 years of intensive development and the production of more than 147,000,000 barrels of crude from the company's properties, the Ventura Avenue field still maintains a large production and is one of the outstanding oil reserves of California. Due to the multiplicity and great thickness of the productive formations, the Ventura Avenue field is in effect several fields superimposed one upon the other. There is no apparent geologic evidence to indicate that additional productive formations will not be developed in this field below the deepest stratigraphic depth attained thus far. The wells currently being drilled into the so-called D-7 zone have depths up to 12,500 feet depending upon topography and are completed under very high pressures and with high potential production. A large number of the wells drilled at Ventura have already produced more than one million barrels each and some of them more than three million barrels.

The company's McGonigle Well No. 21, completed in June, 1946, in the Ventura Avenue field, established the highest daily flow rate of any well completed in California in 1946, despite the fact that the well was brought in under restricted flow conditions. This well is in the D-7 zone and flowed at the rate of 2,577 barrels per day from a total depth of 12,557 feet.

A total of 249,000 acres of prospective oil lands were acquired in 1946, and an intensive program of acquisition of prospective acreage has been continued in 1947, particularly in Wyoming, Colorado, New Mexico and Utah. As of the first of this year the combined company holdings of oil lands, leased or owned in fee, amounted to 125,000 acres of proven lands and 2,150,000 acres of prospective oil lands.

The total underground reserves of crude oil and condensate of Tide Water Associated at the beginning of 1947 were estimated at 471,344,000 barrels, about 57 percent being in the Mid-Continent area. At December 31, 1936, such reserves were estimated 335,000,000 barrels, indicating that, despite a production of some 262,000,000 barrels of crude oil and condensates during the past ten years, the quantity of crude oil economically recoverable on December 31, 1946, has been increased by 136,000,000 barrels.

During the year 1946 the company produced or received as its share from ownership in cycling plants in which it has undivided interests, a total of 1,186,000 barrels of condensates.

In the Mid-Continent division the company owns an interest in twelve cycling projects, nine of which are now in operation and three in the formative stage. The most important of these are Erath, in Louisiana, and Katy near Houston, Texas. The former produces about 15,000 barrels of products from natural gas daily, and the latter approximately 13,500 barrels.

The company also owns, or has undivided interests in large reserves of gas. The sale of this gas represents an important source of income, amounting to $1,676,000 during 1946.

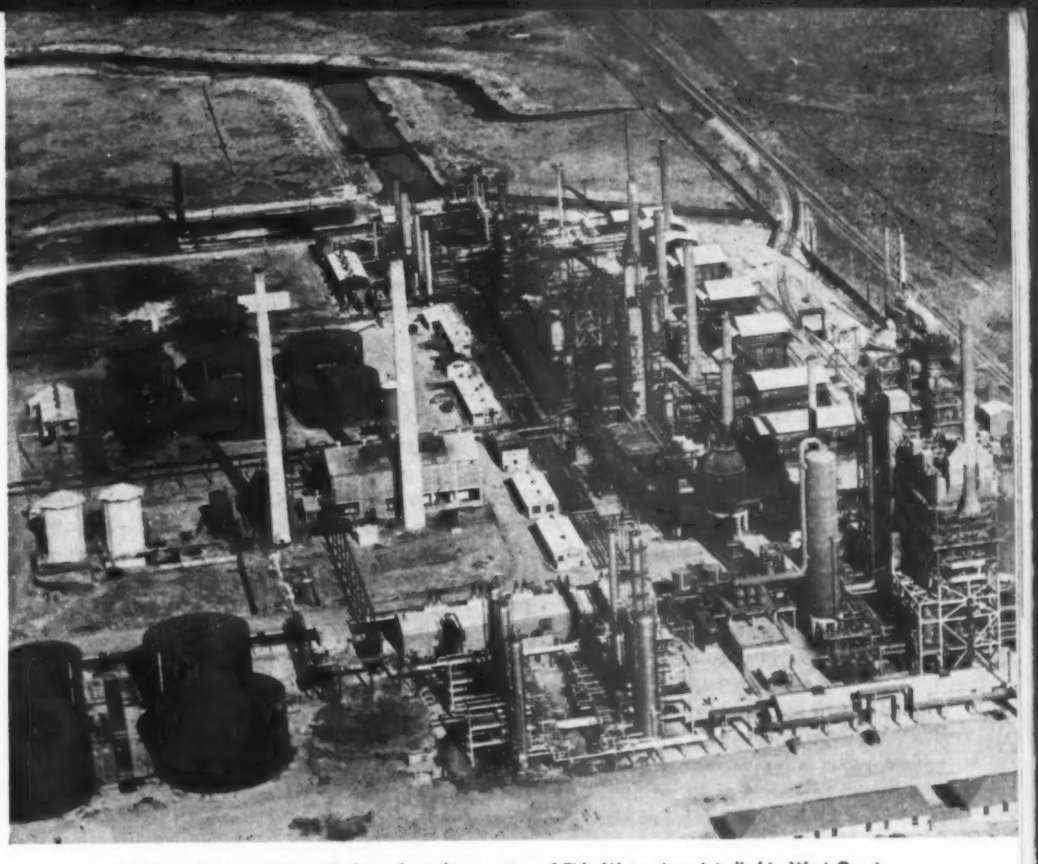
The Eastern division refinery at Bayonne, New Jersey, has a daily crude capacity of 70,000 barrels and a cracking capacity of 30,800 barrels.

The Avon, California, refinery has a capacity of 70,000 barrels of crude and 51,400 barrels daily capacity for catalytic cracking, viscosity breaking and thermal cracking. These figures include a very modern crude distillation unit with a designed capacity of 25,000 barrels per day, placed in operation during July, 1947. About 400 miles south of the Avon refinery is the Watson refinery in the Los Angeles Harbor area, with a crude capacity of 14,000 barrels and a viscosity breaking capacity of 8,200 barrels per day.

In the Mid-Continent area Tide Water Associated's refinery at Drumright, Oklahoma, has a crude capacity of 12,000 barrels and a cracking capacity of 5,000 barrels per day. The total crude oil run to stills in all company refineries in 1946 was 58,842,000 barrels, a daily average of 161,211 barrels.

The sales volume of Tide Water Associated crude oil and products for 1946 was 76,135,000 barrels. The company owns or leases 310 bulk plants and 1,228 service stations.

In the manufacture of lubricants, the company has long maintained a noteworthy prestige, its Veedol oils being manufactured from the high quality Pennsylvania bright stock and neutral oils. The Veedol branded oils are marketed by all three divisions of the company. The Eastern and Mid-Continent divisions also market Tydol Flying "A" gasoline and Tydol Ethyl gasoline, Tydol motor oils, Tycol industrial oils and Tydol clean-burning heating oils. The Western division markets AroTane and Flying "A" gasolines, Tydol motor oils, Cadel heavy duty oils, Cycol industrial lubricants and Associated automatic burner oils. All three divisions are marketing in quantities far exceeding prewar volumes storage batteries, accessories, anti-freeze and tires.



Aerial view of the catalytic and thermal cracking section of Tide Water Associated's big West Coast refinery at Avon, California.

Effective January 1, 1947, the company entered a long-term exclusive contract with the United States Rubber Company to market Federal tires and tubes in all Tide Water Associated marketing territories including the Hawaiian Islands and Alaska. Tires have become an important item in service station merchandise, and in the year 1947 service stations in general are expected to supply 33 percent of the tire requirements in the United States, as compared with only 17 percent in 1940.

The company has always been an aggressive advertiser. Veedol has received national magazine coverage for many years. In addition to the billboard, newspaper and other advertising, the Western division has for the past 22 years broadcast college football games and other athletic events on the Pacific Coast, while the Eastern division is now utilizing the spectacular Tydol Flying "A" airship.

The transportation system of the company includes the 348 miles of gathering systems and 1,333 miles of trunk pipelines. It owns 15 ocean-going tankers, six of which are modern T-2 tankers acquired in 1947 chiefly to replace those lost through enemy action during the war. In addition the company operates eight harbor tankers, 1,029 motor trucks, 1,671 tanks cars and 491 passenger cars. Crude for the company's Bayonne refinery is supplied by company tankers.

Returning to peacetime production, Tide Water Associated surveys with pride its part in the war record of the industry. As part of its war effort Tide Water Associated constructed at a cost of $22,043,000 facilities at its several refineries which were financed entirely out of the company's funds, without any financial assistance whatsoever from the government.

Approximately 1,490 employees, equal to nearly 15 percent of the 10,116 employees working at the end of 1945, were granted leaves of absence for service with this country's armed forces. Ninety-one died in service. Approximately 1,100 who served have already returned to their jobs. Many of the company's executives served on the home front as advisers to governmental bodies.

In research and development Tide Water Associated has made its share of contributions to the petroleum industry. Current emphasis is being placed upon the improvement of motor fuels and lubricants, including recently-developed additive oils. During the war these activities were concentrated on developing products required urgently by the armed services and war production industry. These included aircraft engine

motor oils meeting stringent specifications, heavy duty motor oils for ordnance vehicles, all-purpose gear lubricants, corrosion inhibiting extreme-pressure circulating oils for steel mills, aluminum cutting oils and many others.

The war's unprecedented demand for more effective as well as entirely new types of preservative and rust preventive compositions spurred the company's research resulting in many new products for the armed forces. As an illustration, it was found at the beginning of the North African campaign that an inordinately large number of internal combusion engines in ground vehicles were in poor or even inoperative condition when they were put ashore, due to internal rusting. An urgent demand for a solution was relayed to the petroleum industry; the problem was to preserve the interiors of engines by a rust preventive lubricant which would not have to be drained and replaced during the critical moments after landing, but would be suitable also for immediate full-power combat operation. A Tide Water research team provided the Army with a preservative engine oil which for three months was the only product meeting the difficult requirements. A large volume of Veedol preservative engine oil was shipped during the war.

The company has always been a pioneer in developing high-grade motor oils for specific purposes. In the early days it created a non-chatter oil for Ford cars which was a sensation in the automotive industry at the time. During the war the company delivered very large quantities of grade 100/130 aviation gasoline to the armed forces and, since the war the company is not only supplying grade 100/130, but is also is one of the few manufacturers to supply the new super-grade 115/145 aviation gasoline.

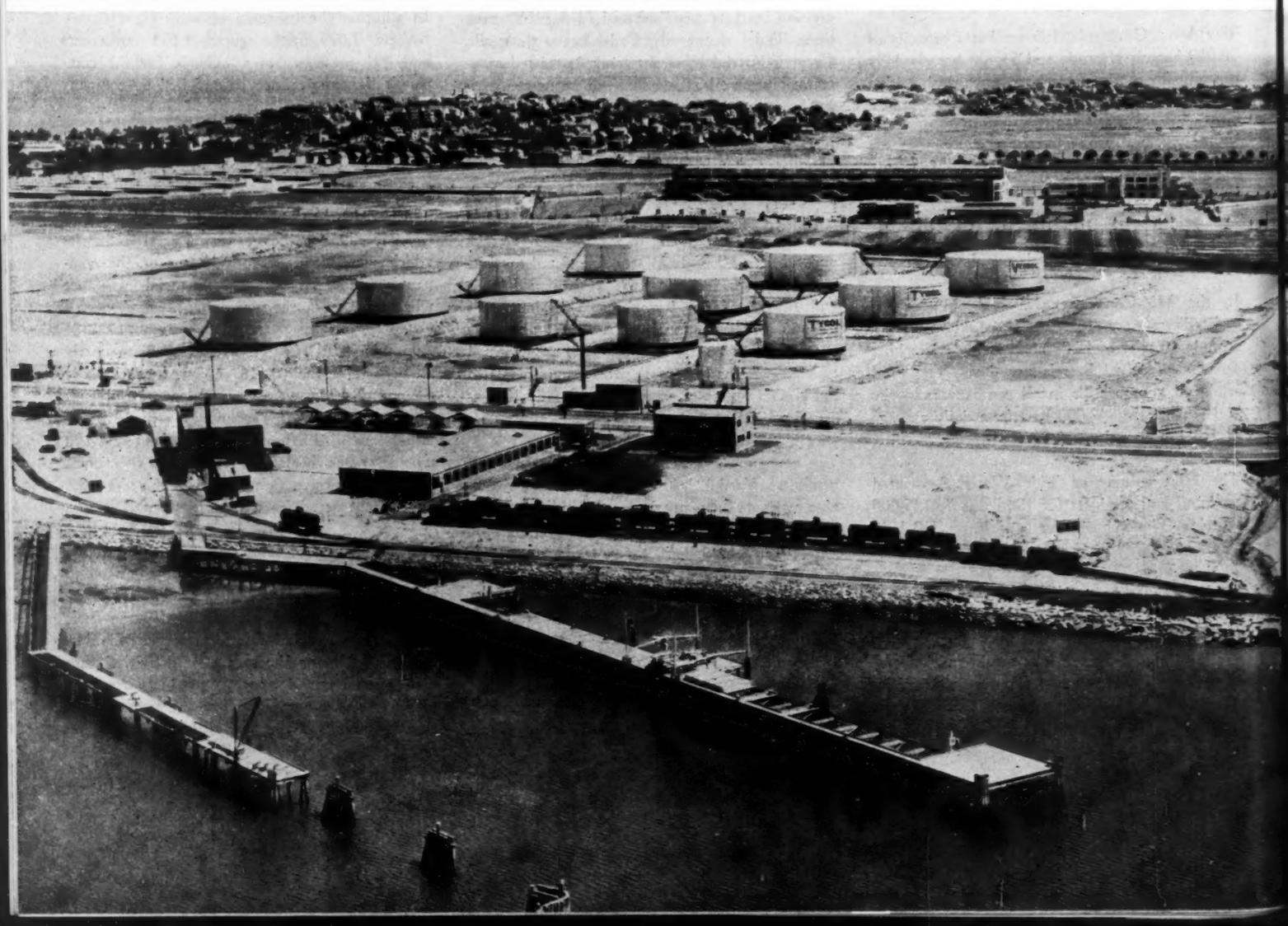
Tide Water Associated's relations with its more than 11,000 employees are satisfactory. There are four employees who have been with the company for half a century or longer; 57 have a service record of between 40 and 50 years; 1,697 have seen 25 to 40 years of service; and 3,619 have been on the Tide Water Associated staff from 10 to 25 years. The average length of service of all the employees is over 13 years.

The company's employee welfare and benefit plans, including group life insurance, sickness and accident benefits, retirement allowances and pay during vacations, are liberal, involving practically no expense to the employees. The company also has an employee suggestion plan which was started twenty-one years ago, long before adoption of similar plans by industry in general. Originally it was initiated for employees of the Bayonne refinery, and almost half of their suggestions have been approved and netted substantial cash awards to employees.

The company is again marketing its petroleum products in many of the 55 countries in which they were sold before the war. In the prewar days the Clarendon Petroleum Company, one of Tide Water Associated's 100 percent owned subsidiaries, sold the company's products at wholesale throughout England; the Hamburg-American Petroleum Company, an almost entirely owned subsidiary, handled branded and unbranded products in Germany and neighboring countries. These operations are now being resumed as rapidly as conditions will permit.

Lubricating oils and greases were and are now being marketed in Canada through a subsidiary called the Tide Water Oil Company of Canada, Ltd. Plans for expansion are going forward.

**Revere, Massachusetts, water terminal of Tide Water Associated on Boston harbor. This bulk plant serves Boston locally and products are trans-shipped to a large area in New England.**



Products were and are being sold in India by a partly owned subsidiary known as the Tide Water Oil Company (India) Ltd., and in Shanghai, China, the Jardine Engineering Corp., Ltd., sells some of the company's products through a limited number of jointly owned facilities.

Before the war Tide Water Associated sold petroleum products, such as gasoline, kerosene, diesel oil and lubricating oils, in the Philippine Islands directly through its own complete marketing facilities, including plants, warehouses, service stations and automotive equipment. These facilities were destroyed during the first year of the war. Since the end of the war the distribution of products by private companies has been resumed and Tide Water Associated has re-established direct operations with offices and staffs in Manila, Cebu, Iloilo, Legaspi and Davao.

The company is re-establishing its sales outlets for lubricating oils in foreign countries as rapidly as governmental restrictions are lifted and shipping is available, and, since the close of the war, shipments of lubricants from the East Coast have been made to the company's distributors in Holland, Belgium, Greece, Portugal, Eire, Norway, Sweden, Switzerland, Iran, Iraq, Egypt, Palestine, Iceland, Turkey, Syria, Union of South Africa, New Zealand and the Gold Coast of Africa.

Lubricants have also been sent to France and its colonies and to the United Kingdom through the respective government purchasing missions. The company's distributors in France and Italy, which were among the company's largest pre-war distributor outlets, are again active and are selling their quota of lubricants imported by their governments, and they are prepared to resume direct purchases from the company as soon as normal commercial trade relations with these countries are restored.

Export trade with the South American and Central American countries is again approaching a normal basis.

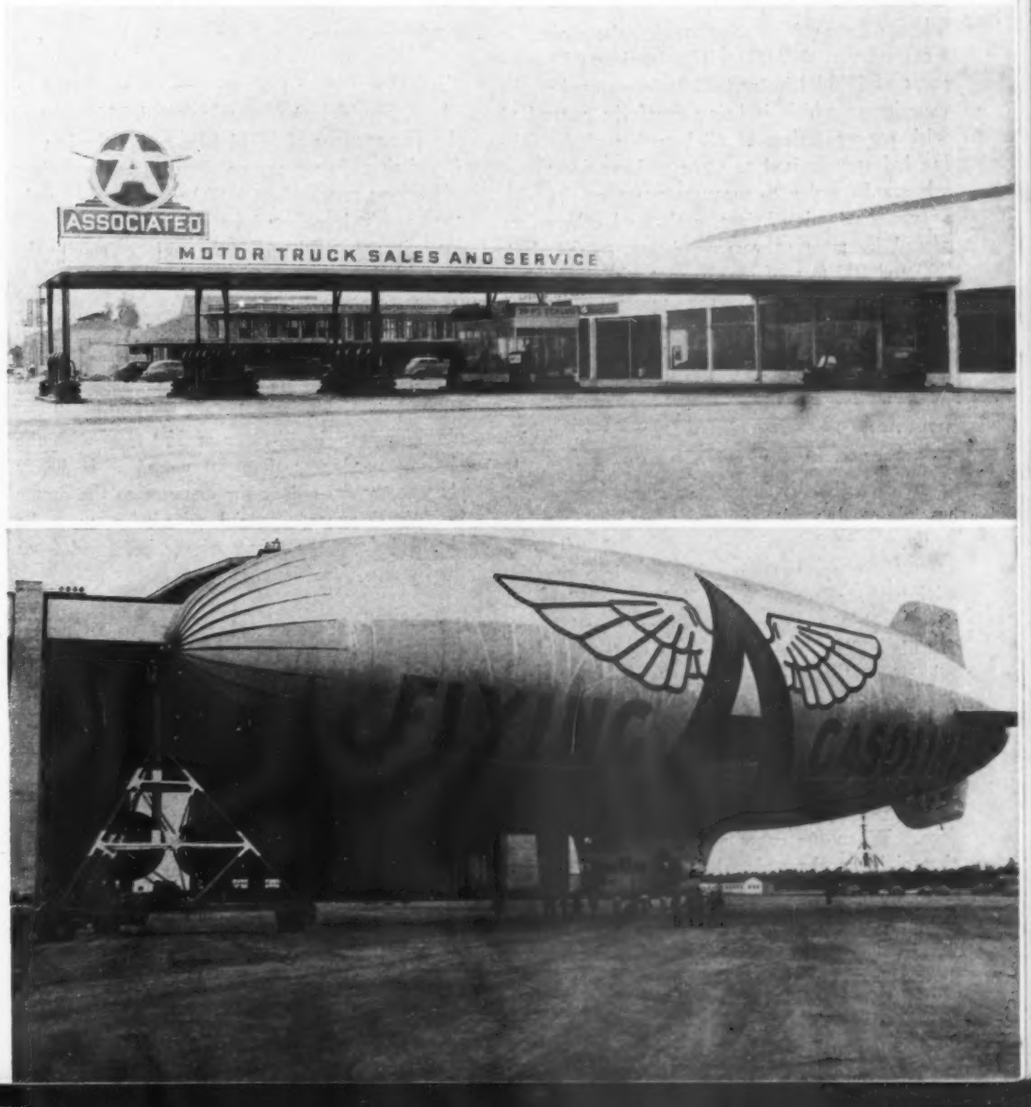
Financially also Tide Water Associated Oil Company has successfully made the transition from war to peace. For the first six months of 1947 the company reported a consolidated net income of $10,907,000 and revenues totaling $138,000,000. The total assets of the company at June 30, 1947, amounted to $242,000,000, and the funded debt of $10,250,000 has since been reduced to $7,250,000. During 1946 expenditures for properties and equipment amounted to $20,456,000. There were 239,623 shares of preferred stock and 6,396,809 shares of common stock outstanding at July 1, 1947.

In addition to the payment to stockholders of a total of approximately $80,000,000 in dividends during the ten years ended December 31, 1946, the common stockholders' equity in the assets of the company has increased from $14.08 per share to $25.43 per share, or a total of approximately $74,000,000, and the total of preferred stock and long-term debts has been reduced from $77,622,000 on December 31, 1936, to $31,212,000 at July 1, 1947.

Tide Water Associated is another of America's great companies which, beginning in a small way, has kept pace with the progress of the country and is now, as ever, ready to play its representative part in the nation's life and economy, with credit to its owners and employees.

Right—A truck service station operated by the western division of Tide Water Associated.

Below—The Eastern Division has been using this blimp as part of its advertising campaign in recent months.



# EFFECTS OF UNDERWATER SURVEYS ON MARINE LIFE

By Julian Leggett

THE scene is set a few miles off the Louisiana Coast where a number of boats carrying scientists and other observers are gathered to watch an unusual test—one of a series designed to determine the effect of underwater explosions on marine life. In the process of surveying structures underlying the waters of the Gulf, oil companies have been setting off dynamite charges ranging from a few pounds to a few hundred while making seismograph records. Fishermen have charged that these explosions destroyed numbers of fish, shrimps, crabs, oysters and other marketable forms of marine life.

In an effort to collect concrete evidence on this disputed point the tests are being conducted. Three oil companies are financing the project at a cost of some $20,000. The Louisiana Department of Wild Life and Fisheries supervises the experiment which is being carefully controlled with representatives of all branches of the fishing industry invited to come and see for themselves. In order to measure exact results, fish of various kinds, shrimp, crabs and others, are placed in cages at varying distances—50, 100, 200 and 400 feet—from the spot where the blast is to be set off. Some of the cages are suspended midway between the surface and the bottom of the relatively shallow areas where offshore surveys are made. Others are on the bottom.

When all is in readiness, the official in charge pushes a lever that detonates the first charge. It is an exceptionally heavy one consisting of 800 pounds of dynamite, several times the strength ordinarily used in oil exploration. A solid column of water rises some 400 feet into the air, giving the effect of a small Bikini. Two oil drums ride the waterspout, and as it settles back a yellow film spreads over the surface, mixing oil and sand with the sea. As the wave subsides, the boats carrying the official observers move forward to examine the cages. One effect not provided for in the preparations is observable as hundreds of menhaden—small fish not edible but used largely as fertilizer—float to the surface. When the cages are opened, it is found that eight croakers placed 50 feet from the explosion are dead, but none of the shrimp have suffered. Out of 100 shrimp used in the test, only one failed to survive, and out of 80 crabs, only 12 died. Of the 64 croakers, only two survived.

Other tests are made with smaller blasts ranging down to 50 pounds of dynamite or less. The 50-pound charges represent about the average shot used in oil surveys. One 50-pound charge set off from the bottom depth of 18 feet sent up a column of water about 75 feet into the air. It killed numbers of menhaden and other small fish swimming in the vicinity, but of 80 crabs subjected to the test, only seven failed to survive, these being all adults that had passed the reproductive stage.

Preliminary results of the project are listed by Dr. James Nelson Gowanloch, chief biologist of the Department of Wild Life and Fisheries: Proof that shrimp are not harmed by explosions of charges ranging up to 800 pounds; that crabs too, are little affected by shock waves of such intensity; that fish suffer the most, especially the more delicate types such as the menhaden.

An earlier experiment, conducted at a cost of $75,000, indicated that oysters seem safe from explosions set off no closer than 50 to 75 feet from their beds. Regulations governing oil explorations set the distance at 250 feet, with the charges no larger than 50 pounds. If heavy charges are desired or the distance to the oyster beds is decreased, special permission must be obtained from the owner of the beds and from the State of Louisiana.

These tests are expected to lead to an agreement between the oil companies and the state authorities for a satisfactory regulation of underwater surveys. This may permit the continued use of small charges without interference while placing special restrictions upon heavy shots carrying from 400 to 800 pounds of dynamite. The state is interested in the preservation of marine life but is anxious also to encourage the production of oil from submarine areas. From the results revealed by the experiments that have been conducted, it appears that a satisfactory agreement should be possible.

Houston, Texas

Early in September this year, shortly after the Louisiana Wildlife Commission had announced that tests conducted under its auspices showed only negligible damage to marine life from the use of explosives in making explorations in the Gulf of Mexico, Texas commercial and sporting fishermen began protesting against oil companies doing exploratory work along the Texas coast.

In an effort to bring about an understanding among all parties, the Commissioner of the General Land Office, Bascom Giles, called a hearing before the Texas School Land Board, composed of Governor Beauford Jester, Attorney General Price Daniel, and the Land Commissioner at Austin, on September 25 to permit a full airing of the question. Following two days of discussion, a seven point program was proposed which was endorsed by all parties concerned, except for a small group of sporting fishermen in the Galveston and Beaumont areas, and a group of commercial fishermen in the Sabine Pass area.

The seven-point program suggested was as follows:

(1) That crews suspend charges of dynamite.
(2) Maximum size of explosives be limited to 50 pounds.
(3) Geophysics crews be prohibited from leaving unlighted buoys.
(4) Crews leave no obstructions such as pipes or concrete blocks on the ocean floor.
(5) Crews be prohibited from "shooting" within certain distance of fishing boats, provided fishing boats were there first.
(6) A state agency be represented with each shooting crew.
(7) All shooting be suspended until marine life has been moved out.

A 16-man committee appointed by the School

Placing one of the cages of marine life in the sea. Buoys hold the cage suspended in water at a predetermined depth.

The shooter sets off a measured charge of explosive.

Land Board met and after considerable discussion presented to the Board a proposed set of rules and regulations. Real progress apparently had been made toward a meeting of minds for proper control of operations in the Gulf.

Then, on October 13, the Attorney General handed down a decision on the applicability and constitutionality of Article 924 V.P.C., prohibiting the use of dynamite and explosives in the waters of the state. The law was declared constitutional and was said to apply to the use of dynamite for geophysical explorations in the Gulf of Mexico.

Article 924, V.P.C. reads as follows:

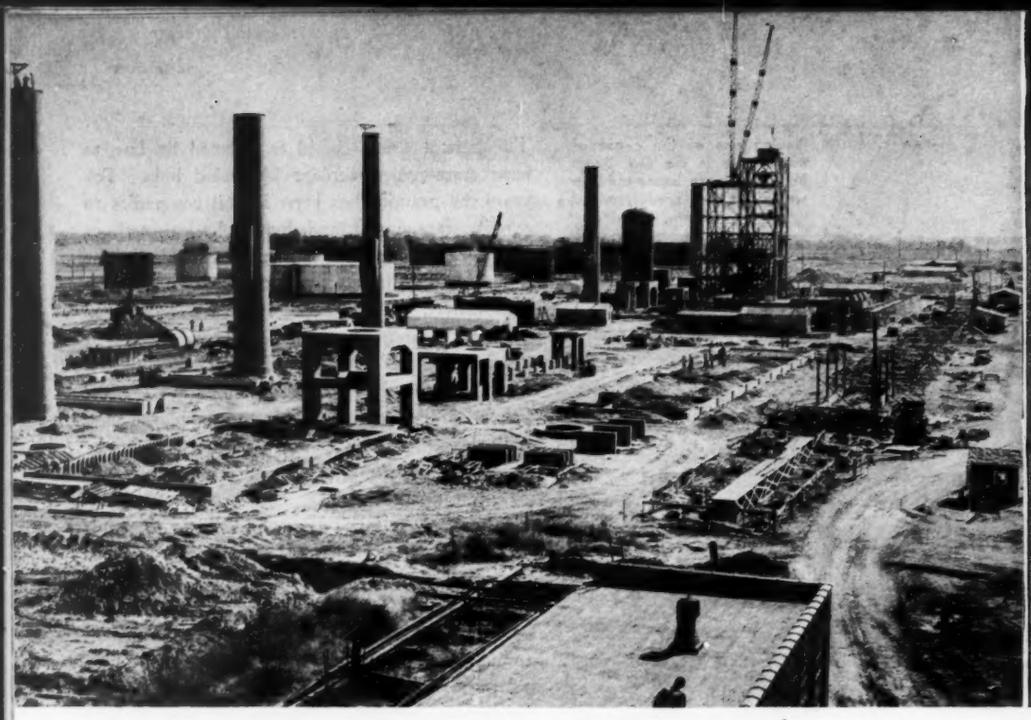
"It shall be unlawful for any person to place in any ways of this State any poison, lime, dynamite, nitroglycerine, giant powder, or other explosives or to place in such waters any drugs, substances of things deleterious to fish life for the purpose of catching or attempting to catch fish by the use of such substances or things, or for any other purpose whatsoever, provided, however, that in event it becomes necessary to place any explosives in waters in connection with construction work, same may be authorized by written order of the County Judge of the County where the work is to be done . . . "

The opinion holds it illegal for oil companies to use dynamite in geophysical exploration in the Gulf of Mexico until they hold leases on the acreage where the exploration is to be conducted. This question has not been passed upon by either the State or Federal courts. The Attorney General's opinion is not final, but unless and until a contrary judicial ruling is obtained, the effect of the opinion will discourage seismic operations in the coastal waters and materially reduce revenue from the sale of leases on submerged lands in the Gulf accruing to the state school fund.

The School Land Board is directed by law to lease state-owned acreage by sealed bids. For years the practice has been for oil companies to explore state-owned lands by geophysical methods and to determine the potential value of these lands for oil and gas development. On acreage thus proved valuable, bids for leases have been made in substantial amounts. Under the recent opinion by the Attorney General, denying oil companies the right to explore lands in the Gulf before bidding on leases, bids on unexplored land will obviously be lower and the state will be deprived of considerable revenue.

Exploratory work may be conducted in the Gulf of Mexico by the gravity meter method which does not employ explosives, but the results are not as accurate and informative as the geophysical method. Bids on leases which have been tested only by gravity meter again will be considerably lower than those on which the more informative geophysical prospecting methods have been used.

Dr. J. G. Mackin representing a Texas college examines one of the fish "guinea pigs" while Dr. James N. Gowanlock, chief biologist of the Louisiana Department of Wild Life and Fisheries, looks on.



Foundations for the new Ohio Oil Co. crude unit. Main laboratory is going up in the background.

R. E. Luton

# OHIO OIL INAUGURATES

By R. E. Luton[1]

COMPLETING sixty years of successful operation, Ohio Oil Company has recently inaugurated a plan of expansion which will greatly increase the capacity of its principal refinery at Robinson, Illinois.

The refinery now operates on Illinois crude and has a rated capacity of 15,000 barrels per day. Present processes include atmospheric and vacuum crude distillation, thermal cracking and reforming, gas recovery and UOP catalytic polymerization. Blending and packaging of lubricating oils are also carried out. Products are gasoline, kerosene, diesel fuel, distillate and residual fuel oils, road oils and asphalts.

Universal Oil Products Company will design and engineer the new units. The general contractor is Arthur G. McKee & Company. J. F. Pritchard & Company is constructing some of the off-site utilities, such as the water supply system, interconnecting piping and power lines that are needed to serve the new units.

New facilities will include a two-stage crude distillation unit of special design, a fluid catalytic cracking unit, a gas recovery plant, a UOP catalytic polymerization unit and a treating plant for gasoline.

The crude distillation unit is designed for a capacity of 27,500 barrels of Illinois crude per day and includes facilities for atmospheric distillation, vacuum distillation and oxidizing or air-blowing of asphalt. The crude oil will pass through a desalting unit before entering the atmospheric column.

The following fractions may be taken off the atmospheric side:

| | Bbl./Stream Day |
|---|---|
| 300°F EP stabilized straight-run gasoline | 4,400 |
| 300°-400°F EP naphtha | 3,575 |
| 500°-530°F EP kerosene | 2,750 |
| 625°F diesel fuel | 2,750 |
| Gas oil | 2,750 |

The light straight-run gasoline end point may be varied from 250° to 350°F and that of the naphtha from 400° to 450°F.

Bottoms from the atmospheric side will be pumped into the vacuum column where the following cuts may be taken off:

| | Bbl./Stream Day |
|---|---|
| Vacuum gas oil | 7,370 |
| Penetration asphalt | 3,130 |

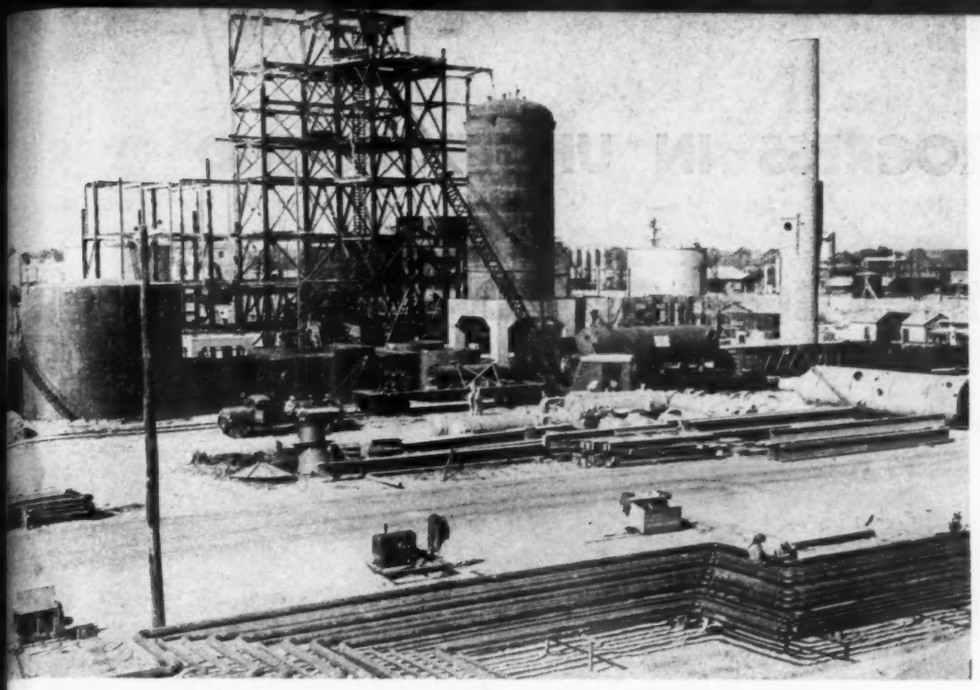
The bottom from the vacuum column may be used as flux or road oil, or they may be passed through the continuous oxidizer to produce asphalt of any desired penetration test, according to market requirements. Continuous oxidation as asphalt is employed because a cleaner and more economical operation is thereby realized. To guard against corrosion, the top section of the atmospheric column is lined with Monel; the remainder of this column, the entire gasoline fractionating column and the vacuum column are lined with 11-13 percent chrome alloy.

A new fluid catalytic cracking unit, embodying UOP features of advanced design, will process Illinois gas oil either on a high conversion recycle basis of 7,500 barrels per stream day of charging stock or on a moderate conversion once-through basis of 12,400 barrels per stream day of charging stock. Either natural catalysts or synthetic catalysts of the ground or microspherical type may be used. This design, by placing the regenerator below the reactor, permits a reduction in the size of the regenerator for a given capacity, marked reduction in length and diameter of catalyst transfer lines, dense phase catalyst transfer from the reactor to the regenerator and a short regeneration air line to the regenerator. The catalyst recovery system consists of three stages of cyclones on the regenerator units for the recovery of catalyst, fines is omitted.

The reactor design includes dense phase horizontal grids, in addition to the main distribution grid, for reducing catalyst recycling in order to prevent further cracking of cracked products and to insure maximum gasoline recovery. Internal and external strippers are provided in the reactor for two-stage spent catalyst stripping. The reactor, external stripper, and main fractionating column are protected from the action of corrosive stocks by use of 11-13 percent chrome alloy steel vessel lining.

Auxiliary equipment of the catalytic cracking unit includes a pressured slurry settler, fired charge heater, steam superheater for the high pressure steam from the flue gas steam generator and the main fractionator steam generators, gas-

[1] Manager Refining Division, Ohio Oil Co.



Progress view of the catalytic cracking unit now under construction.

# REFINERY EXPANSION

engine driven gas compressors, condensing turboblower and special provision for minimizing erosion of the pressure control valve on the regenerator outlet and for silencing at the regenerator flue gas exhaust.

Pumps have been provided with spares, and pump drives are arranged to permit flexibility in balancing the steam and electric power loads. The large pumps have condensing turbine drives. Detailed precautions have been exercised to minimize fire hazard; one feature is the installation of a permanent water fog spray system in the reactor-regenerator structure. Inspection and maintenance are facilitated by trolleys, hoists, platforms and roadways which make all equipment easily accessible.

The light gas recovery system has been designed to recover approximately 70 percent of the propane-propylene and 95 percent of the butane-butylene produced in the thermal and catalytic cracking operations. Products will be separate streams of debutanized gasoline from the reformers, thermal crackers, fluid catalytic cracker and liquid $C_3$-$C_4$ polymerization unit feed.

The present gas recovery equipment consists of a high-pressure absorber, a debutanizer for the reformed gasoline and a debutanizer for the cracked gasoline. The gases from the thermal cracker and reformer are combined and sent to a high pressure packed absorber, using reformer naphtha charge as lean oil.

The liquid from the reformer and thermal cracker receivers is sent to individual debutanizers, the bottom products thus being separate streams of debutanized thermally cracked and reformed gasoline. Overhead streams from each debutanizer are condensed and sent directly to the polymerization feed pretreatment. A Girbotol treatment unit is being installed to remove hydrogen sulfide from the charge to the polymerization unit. Following this operation the charge will be subjected to separate caustic and water washes for final removal of small quantities of sulfur and nitrogen compounds. Sulfur compounds affect the lead susceptibility of the polymer, and nitrogen compounds are detrimental to the life of the polymerization catalyst.

The vent gases from the debutanizers are combined with the main receiver gases and are sent to the absorber of the thermal units.

New facilities will be provided for the recovery of the fluid catalytic cracking unit gas. The new unit will consist of two stages of compression, a high-pressure absorber and a debutanizer.

The main lean oil stream for the high-pressure absorber will be made up of the liquid from the interstage receiver of the compressor system and the liquid from the low-pressure catalytic cracking receiver. A sponge stream of 400°F end point catalytically cracked naphtha from the main column will be charged over the top of the absorber to increase the recovery of butane and pentane. Debutanizer bottoms will be recycled over the main column as an additional absorption medium.

Fat oil from the absorber will be debutanized in the cracked gasoline debutanizer. The overhead will be combined with thermal unit stabilizer overheads and sent to the polymerization feed pretreatment unit. Vent gas from the debutanizer receiver will be combined with the second stage compressor gas as rich gas to the absorber. A common hot oil recirculating system is provided for reboiling all three debutanizers.

The polymerization unit has been designed for production of 1,500 barrels a day of high octane, polymer gasoline from 3,800 barrels a day of charge stock. This charge stock will consist of debutanizer overhead from catalytic cracking, thermal cracking and thermal reforming gas recovery units.

After being pretreated, the charge stock will be polymerized in high-pressure shell and tube type reactors. The temperature of the catalytic reaction is controlled by boiling water around the catalyst tubes, thereby removing the heat of reaction. The generated steam preheats the feed stock. After pressure reduction, the reactor effluent flows to the depropanizer where the lighter hydrocarbons are separated and charged to the ethane column for LPG production. The lightest hydrocarbons are utilized for fuel.

High vapor pressure polymer from the bottom of the depropanizer flows to the debutanizer where polymer and excess butanes are separated.

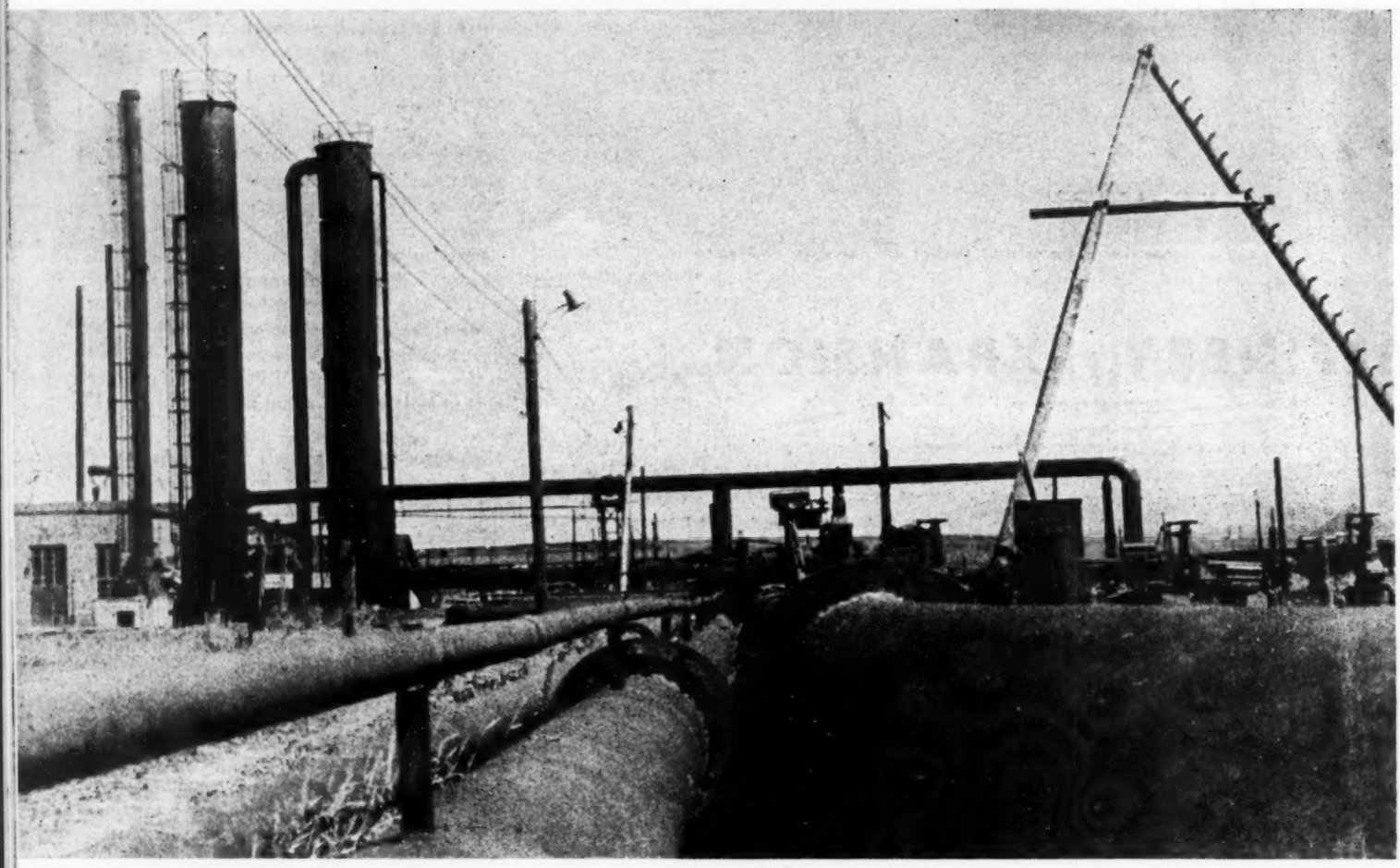
The straight-run gasoline treating unit is designed to handle either low end point or full range gasoline. It consists of a single-stage caustic washer, continuous flow on the gasoline and batch on the caustic.

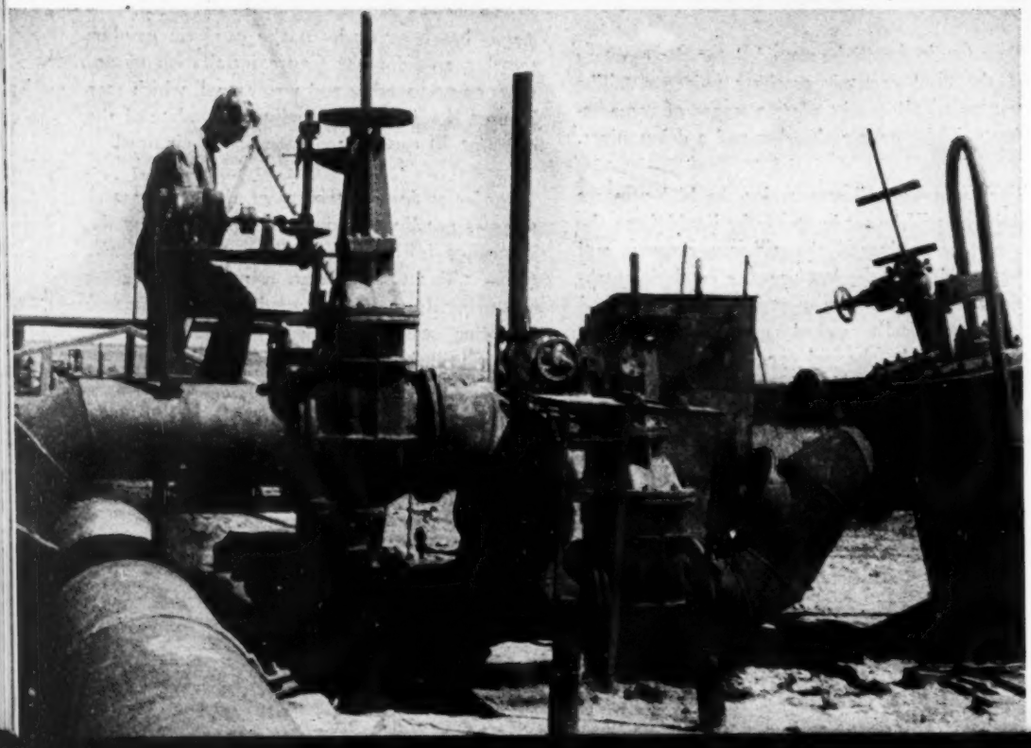
The catalytically cracked gasoline will receive a two-stage caustic wash. The main function of this treater is to remove phenols from the catalytic gasoline. By operating the units so that caustic will flow countercurrent to the gasoline, it is estimated that the phenol content of the caustic in the first stage can be built up to 25-30 percent before the caustic must be discarded. Provision has been made in the catalytic gasoline treating area for the future installation of another caustic washer and water wash which may be used if a market for sodium phenolate of the order of 40 percent concentration is obtained.

In order to insure stability of the cracked and polymer gasolines, equipment is provided for the immediate injection of inhibitor at each of the plants. To insure accurate control the inhibitor measuring drums are mounted on indicating and recording scales. The actual injection of inhibitor will be done by Proportioneers' equipment. The polymer gasoline will be inhibited continuously on its way to storage.

Ground was broken for the new construction last March, and the new installations are expected to be in operation in the summer of 1948.

# RUSSIAN PROGRESS IN UNDERGROUND GASIFICATION OF COAL





Above: Cooled gas lines connected to the main pipeline at the Gorlovka experimental station. Compressor building is at the left. (Sovfoto)

Left: Gas outtake from underground gasifications system at Gorlovka. (Sovfoto)

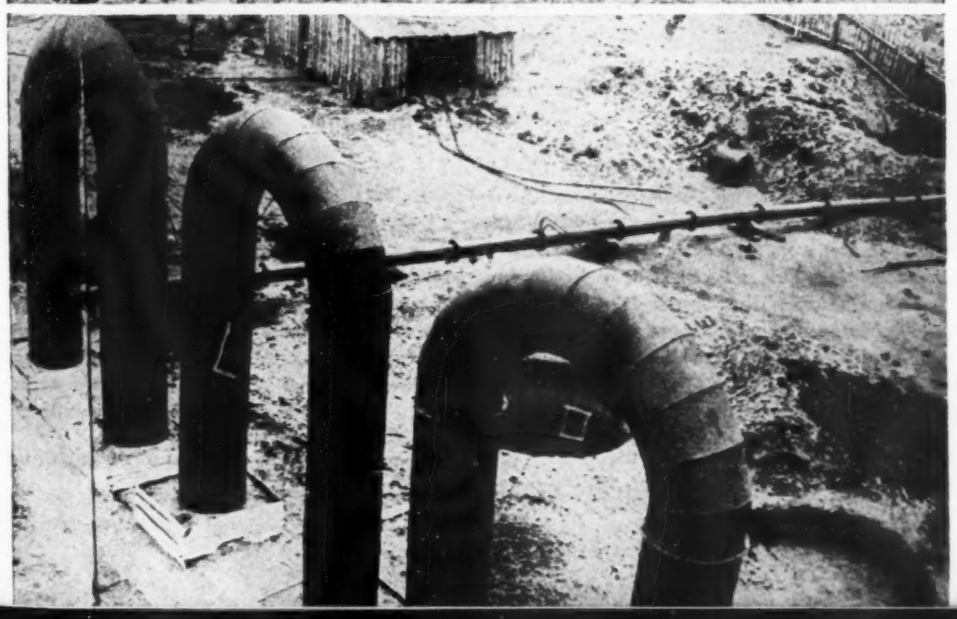
Upper right: Drawing samples through outlets spaced at different points over the area of the coal which is being gasified underground. (Sovfoto)

Right: These return bends are said to be part of the system by which the hot gases produced by underground gasification are cooled. (Sovfoto)

RECENT reports from Moscow indicate that after interruption caused by the war the Russians have resumed work on the project of underground gasification of coal. This work began in the middle 30's and has encountered numerous difficulties mostly connected with a search for the most suitable methods, and has been further held back by shortage of mechanical equipment and facilities for producing industrial oxygen.

The Podzemgaz (Underground Gas), the Russian trust in charge of the project, has two installations in the Donetz Basin and one in the Moscow district. In the Donetz Basin where the coal formations have been somewhat warped by earth movements and the seams are more or less inclined, the Podzemgaz engineers appear to have definitely settled on the "streamline method." In this method two mine shafts 500 to 1,000 feet apart are sunk to the coal seam. From the bottom of one of these shafts a U-shaped tunnel is cut through the coal around to the bottom of the other shaft. Fire is started in one of the arms of the U, and air is blown through to fan the fire; the products of combustion are led out to the surface through the other arm.

Podzemgaz has released little information on the actual operation of the scheme, particularly as regards figures of production. From what has been made known, it appears that the calorific value of the gas ordinarily obtained in the process amounts to from 850 to 1000 kilogram-calories per cubic meter, which is three-fourths of what is obtained from ordinary gas manufactured from the same coal in an above-ground gas generator of the ordinary type. This is due to present difficulties in controlling the combustion so as to keep down the amount of coal that is burned to carbon dioxide; this inert gas amounts on the average to 15 percent of the volume of the gas produced when the fire is supported by air only.



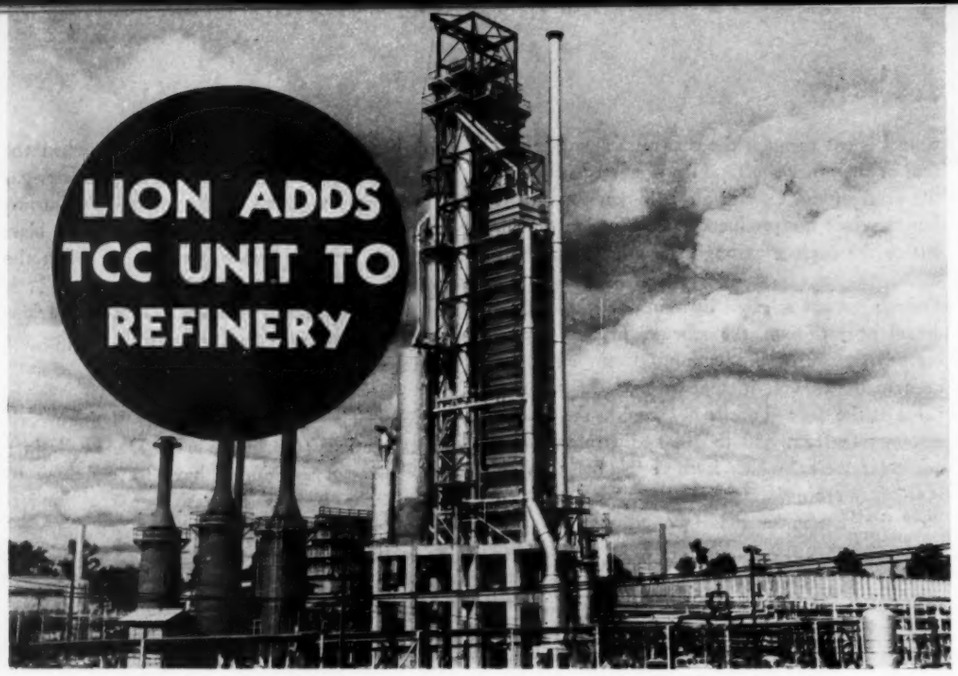
A better quality of gas is obtained when the underground furnace is operated like a water-gas generator; that is, when the coal is first burned with an air draft and after a while with a blast of steam. A still richer gas is made when the air and steam are enriched with oxygen. It is not definitely known to what extent the various projects have been equipped with facilities for producing oxygen at these installations.

It is unofficially stated that at one of the experimental stations (Gorlovka, in the Donetz Basin,) the Podzemgaz engineers have learned how to control the process of gasifying coal underground so that they can produce either "power" gas suitable for use as an industrial fuel for steam-raising purposes, or "process" gas which can be used either for the manufacture of synthetic gasoline or used in the synthesis of ammonia. These developments would be in part the equivalent of the synthine process which is getting underway in the United States and is what the Bureau of Mines and the Alabama Power Company have been attempting.

It is said that a coal seam can be equipped to produce gas in the underground gas generator for two-thirds of the cost of building an above-ground gas generator to work on the coal after it has been mined and brought to the surface. In addition there would be the advantage that the number of workers needed to operate an underground gas generator is only a fourth of the number required to dig sufficient coal to furnish the equivalent number of heat units.

The coal seams that are being worked by underground gasification in the Donetz Basin are steeply inclined with firm roofs and floors, and no problem of drainage of formation water is presented. In the Lower Moscow Basin the coal formations are horizontal and efficient drainage is required. The Lower Moscow coal is of inferior quality and contains up to 30 percent of ash. The overlying rocks are soft and crumbly, and the driving of tunnels through the formations is regarded as impracticable. However, the coal itself is more or less fissured, so the "filtration method" of gasification has been given serious consideration for this region. In this method two holes situated at appropriate distances are drilled to the coal seam; a fire is started in the bottom of one hole, a draft of air is forced in, and the resulting gaseous products seep through the coal and are taken out of the other hole. It is unnecessary to do any underground mining.

The Russian press and propaganda agencies are making much of this project, picturing a rosy future when the cost of fuel will be greatly reduced and hundreds of thousands of miners will be freed from hard and dangerous underground mine work. Podzemgaz engineers have at least proved that underground gasification of coal is physically possible, but little concrete information as to the results obtained is forthcoming.




LICENSED by the Houdry Process Corporation and constructed by The Lummus Company at a cost of $1,500,000, the thermofor catalytic cracking unit of Lion Oil Company went into operation recently at the company's El Dorado, Arkansas, refinery. It was designed to produce a maximum yield of high octane gasoline and incorporates the most recent improvements in the catalytic cracking process.

The feed to the unit is a heavy gas oil charging stock and is taken directly from the crude by distillation. The products obtained, in addition to the gasoline, include gas, butanes, burner oils and fuel oil. Operation of the unit may be conveniently divided into three sections as follows: (1) feed preparation; (2) catalyst section; (3) product separation. These three sections will be considered in order.

In feed preparation 4,700 barrels per day of the gas oil charge are heated by heat exchange and then mixed with 900 barrels of recycle gas oil separated from the cracked products. This combined stream is then heated until it is principally vapor by three upright heaters, two of which operate in parallel. Unvaporized tars are then removed (about 200 barrels per day) and the vapors are further heated in a superheater. The final product of the feed preparation section is a stream of 5,400 barrels per day of vaporized heavy oil at 880°F. In the accompanying illustration the three upright heaters are seen to the left of the main structure, and the tar separator and superheater are just beyond.

The center of interest of the new unit is the catalyst section, the large central structure of the picture. The catalyst used is the so-called "bead" form developed during the war.

The three principal pieces of equipment in the catalyst cycling system are: (1) the reactor, a large vessel part of which can be seen at the upper left of the catalyst structure in the illustration; (2) the kiln, the large rectangular structure on the right; and (3) the elevator, seen as the long central tube within the ironwork. These pieces of equipment are supported on a concrete and steel structure, the highest point of which is 200 feet above grade.

The reactor, 12′ x 97′, was prefabricated in the Houston shops of the Wyatt Metal and Boiler Works and was delivered to El Dorado by special train. The upper section of this vessel is the storage hopper for the catalyst to the reactor. The central section consists of catalyst storage and a pipe or "leg" for carrying the catalyst downward. The weight of the catalyst in this leg is sufficient to maintain the flow of catalyst against the pressure in the reactor. The bottom section is the reactor proper where the cracking takes place. In the operation the hot burned catalyst from the top of the elevator flows into the storage hopper and then down the leg and into the reactor. The catalyst is distributed over the reactor and flows through it slowly as a bed 12′ in diameter and 11′ deep.

The hot oil vapors from the feed preparation section enter the reactor above the catalyst level and flow down through the catalyst bed. At the bottom of the reactor the product vapors flow to the fractionating section to be separated into the final products. The catalyst, which now contains about three percent carbon, returns to the bottom of the elevator.

The kiln is a rectangular vessel, 10.5′ x 10′ and 95′ long. Prefabricated sections were assembled at the site and the entire structure was lifted into place as a unit. The interior lining of refractory, the steam coils, air ducts and other interior parts, were then installed. The kiln is divided into nine burning zones, each of which is equipped with an air inlet and outlet and a steam coil. The catalyst flows to the hopper from the elevator and is distributed evenly over the area of the kiln. It flows down through the nine burning zones of the kiln as a solid bed. In each zone sufficient air is admitted to burn part of the carbon, and the heat generated is removed by the steam coils. The burned catalyst is collected evenly from the bottom of the reactor and returned to the elevator.

The elevator is a single bucket and chain arranged to carry simultaneously both the coked catalyst from the reactor and the regenerated catalyst from the kiln. The hot catalyst from the kiln is carried in a central section of the bucket and the colder catalyst is carried in sections adjacent to the chain. This protects the chain from the high temperatures of the regenerated catalyst. In wartime units of this type, two chains were used. The elevator is suspended from the top and is driven by a sprocket wheel connected to a steam turbine. It is enclosed in a shaft or tube filled with inert gas. The flow of the catalyst through the reactor and kiln is controlled by valves at the bottom of the elevator that feed the catalyst to the elevator. The flow is 75 tons per hour for each stream or 150 tons total.

The low-pressure air required for the kiln is supplied by a centrifugal compressor, and an "airline" burner in the air duct to the kiln furnishes the heat required for start-ups. An "inert gas generator" furnishes a non-oxidizing gas for the elevator shaft and for stripping oil vapors from the catalyst. An "elutriator" removes disintegrated catalyst or fines by blowing them from the catalyst stream with gas. A steam drum and feedwater preheater are necessary with the steam coils of the kiln.

The fractionator, a 12.5′ x 64.5′ column with 20 plates, is lined with stainless steel for the bottom two-thirds. Uncondensed gases from this column are compressed and sent to the refinery gas recovery system where they are separated into fuel gas, butanes and a fraction that is polymerized into a high octane "poly" gasoline. A stream of burner oil is withdrawn from the side of the fractionator and a steam of heavy fuel oil, which contains the tars formed in the reaction, is withdrawn from the bottom. In addition, a circulating stream of hot gas oil is withdrawn from near the bottom of the fractionator to furnish heat for the gasoline stabilizer and for the cold feed to the unit. Also the 900 barrels per day of recycle is withdrawn from near the bottom of the fractionator.

The unit is connected to the refinery steam system, but the coils in the kiln supply practically all of the steam required in normal operation. The process pumps are steam-driven for dependability. The unit has its own cooling tower. A substantial portion of the pipe was prefabricated of alloy steel for streamline flow and corrosion resistance. The process piping is painted in different colors according to the stream carried. The ground area of the unit is paved.

ACCURATE INDICATION • DEPENDABLE PERFORMANCE

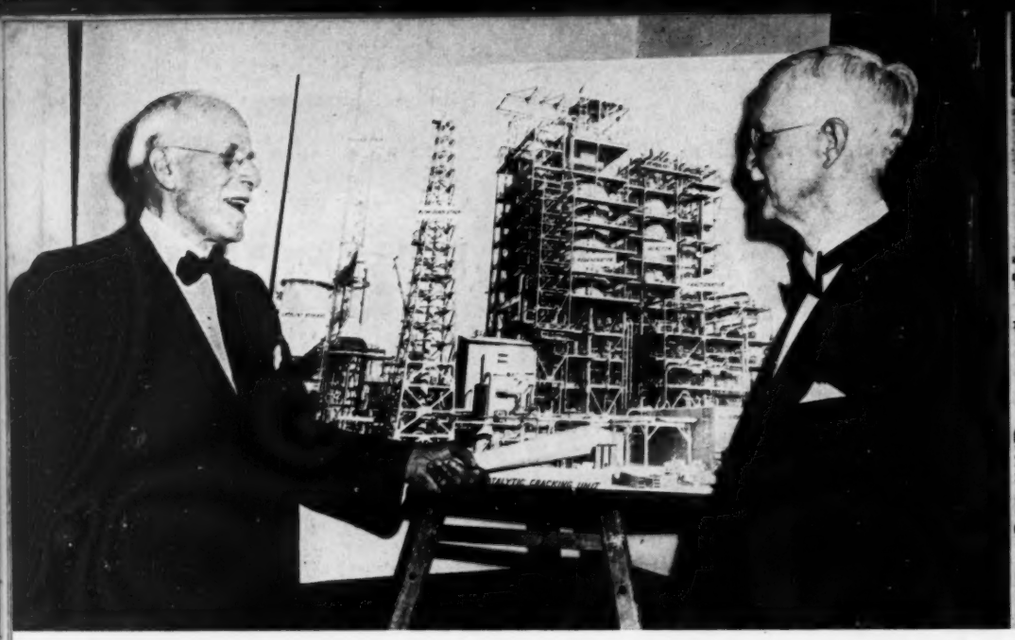
# Klinger LIQUID LEVEL GAUGES FOR REFINERIES AND STILLS

Richard Klinger Ltd., are specialists in the manufacture of direct reading liquid level indicators for the Oil Industry, and make a wide range of types to meet the varying conditions of service.

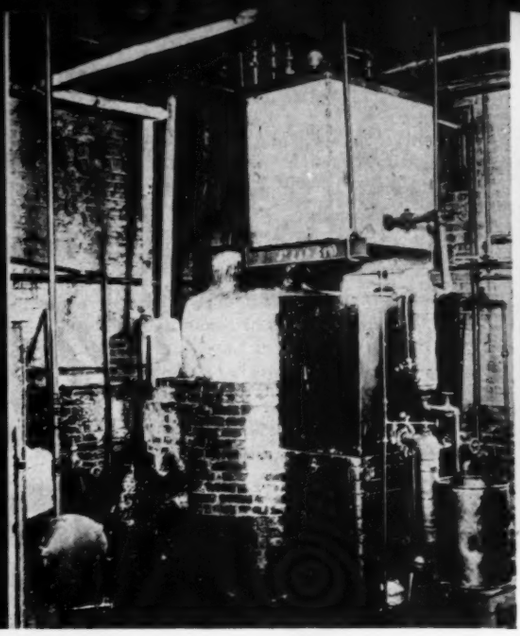
**"K" Type Reflex Gauges** for oil pressures up to 1,200 lbs. per square inch and steam pressures up to 500 lbs. per square inch. They are available in a full range as single or combined units and have forged steel bodies with stainless steel tightening nuts and end tubes. Reflex gauges are also made for higher pressures up to 6,000 lbs. per square inch.

**"J" Type Double Plate** or Thru-Vision gauges for working pressures up to 500 lbs. per square inch are recommended where coloured or opaque liquids have to be indicated. Heavier pattern Double Plate gauges are available for pressures up to 2,000 lbs. per square inch. *Other Klinger Fittings for the Oil Industry include Hubbard Patent Level Gauges for liquefied gases, Boiler Water Level Gauges, Tank Gauges, etc.*

**RICHARD KLINGER LTD • KLINGERIT WORKS • SIDCUP • KENT • ENGLAND**



Dr. William M. Burton, left, and his long-time associate Dr. Robert E. Humphreys when they were honored at a dinner of the Newcomen Society of England.



The first experimental still in which Dr. Burton carried out his exploratory work on oil cracking.

# PIONEER IN OIL CRACKING HONORED

AT its recent meeting in Chicago the American Petroleum Institute awarded to Dr. William M. Burton its gold medal for distinguished achievement, which was presented by William R. Boyd, Jr., president of the Institute.

Presentation was made the occasion for a review of the situation that made invention of the Burton oil-cracking process necessary, and a description of the circumstances under which the invention was accomplished.

Around about 1909 the automobile industry was growing so rapidly and the demand for gasoline was increasing to such an extent that the petroleum refiners began to see difficulty ahead in providing enough fuel to run the number of cars that were appearing on the roads. The difficulty was that oil refining was then limited mostly to simple distillation with a gasoline yield of only about 18 percent.

In preparation for the coming demand, Dr. Burton and his associates, Drs. Robert E. Humphreys and F. M. Rogers, began experiments on breaking up the large molecules of the heavy distillates into smaller molecules that could be burned in automobile engines. Many difficulties were encountered in getting the process going. Experiments had previously been made in applying pressure and heat to the cracking of petroleum, but no practical conclusion had been reached. The three pioneer Standard chemists first tried heating without pressure, but the yield was poor and the product unsatisfactory. They then tried heat and pressure and found that a pressure of 95 pounds per square inch and a temperature of about 750° applied to a gas oil fraction would break it down into gasoline and other petroleum products.

The Burton research was done when these pressures and temperatures were exceedingly high for the metals then available. When the steel of the stills was weakening at the high temperature and the seams were likely to part from the pressure, it took courage to continue the experiments. Even a 100-gallon pilot-plant still had to be caulked because it leaked at the rivets and seams when hot.

When Dr. Burton had finally worked out the idea, using a crude hot still, and requested one million dollars from the board of directors of the parent Standard Oil Company to build a battery of production stills, he was told, "No, you'd blow the whole state of Indiana into Lake Michigan!" When Standard of Indiana became an independent unit, Dr. Burton requested $800,000. The question was asked, "Are you sure you know what you are doing?" he answered, "Yes!" He got the money and he knew what he was doing, as events proved. By January, 1913, the first twelve Burton stills were in successful operation, their capacity being 8,250 gallons each. And by 1922 their number had increased to 893.

During the first 15 years the Burton stills were in use, they saved over one billion barrels of crude which would have been required to make the same amount of gasoline under the old skimming methods. Standard Oil Company (Indiana) licensed the Burton process to competitors and thereby started what has become a common practice in the industry—the licensing of inventions freely at reasonable royalty rates.

Dr. Burton becomes the second recipient of the American Petroleum Institute's gold medal. The first was Henry Ford who developed the mass-production methods that enabled the automobile industry to put cars within the reach of the common man. It is perhaps to Burton and Ford, more than to any other two men, that the public is indebted for the convenience and pleasure of cheap automotive transportation. Burton and Ford's developments were largely responsible for the rapid growth in the use of automobiles during the second and third decades of the 20th century. Without a great increase in production of suitable inexpensive fuel, mass production of automobiles would not have been practicable, and without a rapid increase in production of motor cars, there would have been little need of increasing gasoline yield.

Previously Dr. Burton received the Willard Gibbs medal of the American Chemical Society in 1918 and the Perkin medal of the Society of Chemical Industry in 1922. The latter award is the highest honor that any individual can attain for work in applied chemistry in the United States.

Dr. Burton was born in Cleveland, Ohio, November 17, 1865. He received his AB degree from Western Reserve University in 1886 and his Ph.D. degree from Johns Hopkins University in 1889. In 1890 he entered the employ of Standard Oil Company (Indiana) as its first chemist at the Whiting refinery. He became general superintendent in 1895, a member of the board a directors in 1911, and served as vice president from 1915 until 1918 when he became president.

He resigned the presidency of the company in 1927 but continued in an advisory capacity as a member of the board of directors until 1928. He is at present a resident of Cambridge, Mass.

Jack C. Dart  Dr. Alex G. Oblad

## New Houdry Researchers

Dr. Alex G. Oblad has been appointed director of chemical research of Houdry laboratories and Jack C. Dart was made director of development. The new men will make their headquarters at the Houdry laboratories near Marcus Hook, Pennsylvania. Both Dr. Oblad and Mr. Dart have had broad experience in the petroleum industry. Dr. Oblad has done research work for Standard Oil Company (Indiana) and Magnolia Petroleum Company. Mr. Dart has served Pan-American Refining Corporation, Magnolia Petroleum Corporation and Standard Oil Development Company.

## Buys Interest With Shell

Royal Dutch Shell has sold a half interest in its Netherlands producing concession to Standard Oil Co. (N. J.), and the two have organized N. V. Nederlandsche Maatschappij as an operating company to develop the Coevorden field. (W. P. November, 1946, P. 66-68.) Oil is to be processed at Rotterdam by Shell's refinery to which a pipeline is to be laid.

T. M. Martin

**COL. T. H. BARTON,** president of Lion Oil Co. since 1929, has been elected chairman and has been succeeded by T. M. Martin, vice president since 1929 and executive vice president since 1939. The office of chairman has been vacant in the past. Col. Barton announced that expanding activities of Lion warrant an active board chairman. During the nineteen years in which he served as president, net worth of the company has grown from $7 to $25 million and total assets from less than $10 to almost $40 million.

Mr. Martin has been active in the petroleum business since 1923 at which time he was engaged in the oil brokerage business in Chicago. Later he served as general manager of Diamond Petroleum Co. at Louisville, Kentucky, which became a part of the Mid-Continent Petroleum Corp. In 1929, at the age of 34, he was elected director and vice president of Lion Oil Co. He is a director of the Independent Petroleum Association of America and a vice president of the Western Petroleum Refiners Association.

**ANTHONY J. ZINO, JR.,** has been appointed assistant sales manager of the industrial sales division of Swan-Finch Oil Corp., New York. Mr. Zino was for eight years New York sales manager of Lubri-Zol Corp. and for the last five years eastern manager of the lubrication department of E. F. Houghton & Co.

**FRANKLIN W. BATES** has been appointed West Coast counsel for the Arabian American Oil Company and Trans-Arabian Pipe Line Co. His appointment follows the recent selection of George W. Ray, Jr., formerly with The Texas Co., as general counsel for Aramco and Tapline. Mr. Bates formerly was with a San Francisco law firm.

The perfect
rust inhibitor is
R.L.G. primer—Red Lead and Graphite
finely ground in an oil varnish medium.

THE INTERNATIONAL PAINT AND COMPOSITIONS CO., LTD.,
Grosvenor Gardens House, London, S.W.1

# International News and Notes

C. E. Franks

## Returns To U. S.

C. E. Franks, managing director for 25 years of the Wayne Tank and Pump Company Limited, of Sydenham, S. E. 26, is shortly leaving London to return to the United States to become executive vice president of The Wayne Pump Company, Fort Wayne, Indiana.

## Barinas Discovery

The Socony-Vacuum Oil Company of Venezuela has discovered oil in its Barinas acreage south of the Andes in western Venezuela. The Silvestre No. 2 well was bottomed at 9,766 feet and casing cemented at 9,529 feet. Testing, which is still in progress, has been somewhat hampered by mechanical difficulties. Figures are as yet not being made available. It is understood, however, that the pressures in the well are lower than might normally be expected, and additional exploratory drilling will be necessary before the significance of the present development can be evaluated.

## Venezuelan Production

Production of crude oil in Venezuela during the month of September amounted to 36,929,522 barrels. Exports for the month were 33,720,444 barrels. Production by companies was as follows:

| Company | West | East | Total |
|---|---|---|---|
| Creole | 13,418,915 | 4,594,761 | 18,013,676 |
| Mene Grande | 1,778,340 | 4,512,491 | 6,290,831 |
| Shell | 10,736,122 | — | 10,736,122 |
| Consolidada | — | 610,199 | 610,199 |
| Socony | — | 859,607 | 859,607 |
| Texas | 191,160 | 175,368 | 366,528 |
| S. A. Pet. Las Mercedes | — | 1,177 | 1,177 |
| B. C. O. | 37,964 | — | 37,964 |
| Orinoco | 7,688 | — | 7,688 |
| Phillips | — | — | — |
| Varco | — | 5,730 | 5,730 |
| Guasare | — | — | — |
| Total Barrels | 26,170,189 | 10,759,333 | 36,929,522 |

## Cancels Sales Agreements

The gasoline sales agreements between Yacimientos Petroliferos Fiscales, Argentine government oil company, and private oil companies operating in Argentina have been cancelled. The reduced gasoline supply in the world market and the increased Argentine import demands for gasoline and crude oil for the Five Year Plan determined the government decision.

In making the announcement, the Argentine government pointed out that the sales agreements were out of date, since they were made when world supply was abundant, and since the covenants in the sales agreements binding YPF to the Court of Arbitration resolutions are opposed to the spirit of the present government which considers that national welfare can be under no regulation other than that of government authorities.

YPF also said that the cancellation of the agreements will allow an increase in the supply of gasoline to small marketers whose sales quotas were restricted under the old agreements.

Baba-Zade (left) shown inspecting a section of the new field he discovered.

## Russians Discover New Field

Two young Soviet geologists, Baba Baba-Zade and Sakykh Jafarov, recently received Stalin prizes for their joint discovery of a major oil field in Azerbaijan. This was the second such discovery for Baba-Zade. Following a boyhood ambition, he became an oil engineer and in the course of drilling in the old Kala settlement near Baku he located a rich deposit which became the center of the new Azizbekov oil district.

Jafarov, meanwhile, was working in the older Baku fields in the Lenin district. Between the two sections lay a depressed area, Buzovny-Mashtagi, which had been considered hopeless as an oil prospect. Both geologists formed the conclusion that the two fields probably were connected. Working at first from opposite directions and later together, they finally succeeded in bringing in well No. 1056, uncovering a new oil basin which has been named Buzovny. A new oil trust—Buzovny Neft—was formed which from its beginning has figured prominently in reports of output from the Baku fields.

This is the second honor conferred on Baba-Zade. He had previously received the title of Hero of Socialist Labor.

## British Cooperatives Approve Plan

British Cooperatives, at a meeting held on November 7, endorsed the program put forward by the International Cooperative Petroleum Association at its recent meeting in London and agreed to participate in it. The plan of the International is to establish oil cooperatives in the principal European countries and to engage in all branches of oil operation from production to marketing. Erection of a refinery in the United Kingdom is projected as part of its future development.

## MacMillan's Sicilian Exploration

In a report from Italy published in the October number of WORLD PETROLEUM, it was stated that Macmillan Petroleum Company was drilling test wells on its concession in Sicily. This report was incorrect, or at least premature, according to information supplied by the Macmillan Company. The activities of the company have reached only the stage of selecting favorable locations for test drilling on the 70,000 acres covered by exploration permits which it has received from the Italian government. Exploratory drilling will follow as encouraging reports have been received from the geologists conducting the preliminary survey.

According to a statement by the company, its Sicilian holdings consist of six blocks comprising 28,400 hectares. Selection of these tracts was made by Dr. E. K. Soper, for many years professor of geology at the University of California at Los Angeles, under whose direction a comprehensive study of the area was made before the recent war. During the past two years negotiations with the Italian government by Engineer Franco Fenzi, representative of Macmillan at Rome, have confirmed the concession and paved the way for a continuation of the survey work which is now proceeding under the direction of Dr. Soper collaborating with Ezio Beneo, Italian government geologist.

## Visits Middle East

Hearn J. Paschall, sales and service engineer of the H. C. Smith Oil Tool Co., is now in the Middle East where he is making an extensive tour of the various oil fields throughout that area. Mr. Paschall is making his headquarters at Cairo and will be the exclusive representative for his firm in the Middle East.

Hearn J. Paschall

## From "Flying Box Kite"...

## to 500-Mile-an-Hour "Jet"...

# PETROLEUM'S BEEN ON THE WING!

ONE DAY in 1903, the Wright brothers flipped a coin to decide who would get the chance for the first airplane flight in history.

Nothing else was left to chance! Years had been spent in research—a new engine built. And to assure its performance, we had supplied a special petroleum lubricant.

Since then, the petroleum industry and Socony-Vacuum have smoothed the way for aviation's greatest feats. Mobiloil flew with Lindbergh, Byrd, Wiley Post, Amelia Earhart!

After Pearl Harbor, the petroleum industry united to turn out countless barrels of 100 octane aviation fuel and revolutionary new lubricants that assured top performance and safety under all combat conditions.

Today, with jet planes topping the speed of sound, Socony-Vacuum has set up a special laboratory to develop new fuels and lubricants for jet propulsion and gas turbines.

There's no ceiling on what aviation can do with petroleum as a partner!

## —81 YEARS' LEADERSHIP in a Progressive Industry—PETROLEUM

SOCONY-VACUUM OIL COMPANY, INC.
and Affiliates:
MAGNOLIA PETROLEUM COMPANY, GENERAL PETROLEUM CORPORATION

SOCONY-VACUUM

## OIL COMPANY STAFF CHANGES

Leonard F. McCollum

M. MacIver

**LEONARD F. McCOLLUM,** formerly coordinator of producing activities of Standard Oil Co. (N. J.), has been elected president of Continental Oil Co. He succeeds Dan Moran who resigned because of ill health. Mr. Moran will continue to advise the company in a consulting capacity.

Mr. McCollum was born in 1902 in Bradford, Tenn. He majored in geology at the University of Texas and after graduation in 1925 he joined the Humble Oil and Refining Co. as a geologist in the company's operations at Amarillo and San Antonio. In 1934 he was assigned to the Carter Oil Co. as chief geologist and manager of exploration and later became president of the company. In 1943 the parent company brought Mr. McCollum to New York, and a year later he was made coordinator of the world-wide operations of the company.

Mr. Moran was born in Cygnet, Ohio, on May 31, 1888, and has been connected with the oil industry since 1905 when he obtained his first job with the Buckeye Pipe Line Co. while still at school. Upon completing his education he joined The Texas Co. and worked for several years in the oil fields. Later he was engaged in the construction of numerous bulk plants along the Atlantic Coast and a refinery at Port Arthur, Tex. In 1921 he was made vice president and general manager of The Texas Company of Mexico and built two refineries and extensive pipeline facilities in that country. After being called back to the United States, he became general manager of the company's producing department and subsequently was elected a vice president, director and member of the executive committee.

Mr. Moran's connection with Continental Oil Co. began in 1928 when he became president of Marland Oil Co. Under his direction the company was completely reorganized and its name was changed following the acquisition of the assets of Continental Oil Company (Maine) in 1929. Mr. Moran has concentrated his efforts on the development of Continental's crude oil reserves, as a result of which the company's annual production increased from approximately 13 million barrels in 1928 to an estimated 37 million barrels in 1947.

**M. MACIVER** has been elected vice president of California Texas Oil Co., Ltd., in charge of fiscal matters. He succeeds the late William Kunstadter who died of a heart attack earlier this year. Mr. MacIver came to the Caltex organization as general auditor in 1938. He was appointed comptroller in 1946.

**JOHN W. BRICE,** who for the last twenty years has been engaged in exploration and producing activities of Standard Oil Company (New Jersey) and affiliates, has been appointed coordinator of producing activities for the company. He succeeds L. F. McCollum who has resigned to become president of Continental Oil Co.

Mr. Brice joined the Humble Oil & Refining Co. as a geologist in 1927 and later served with Jersey affiliates in Venezuela. He served The Carter Oil Co. in Tulsa, Oklahoma, as executive vice president and director before coming to New York as assistant coordinator of Jersey's producing activities.

John W. Brice

**DR. DONALD G. ZINK,** formerly director of technical development of U. S. Industrial Chemicals, Inc., has joined the staff of Stanolind Oil and Gas Co., Tulsa, Okla., as superintendent, chemical products department Dr. Zink joined U. S. Industrial Chemicals, Inc., in 1934 after receiving his Ph.D. degree from Johns Hopkins. He served that company as chemical engineer, director of plant development laboratory, director of technical sales and products development and director of technical development.

**M. H. BANKS** has been appointed as manager of employee relations of Standard-Vacuum Oil Co. to succeed J. J. Waters who is retiring. Mr. Banks joined the organization in 1923 and was assigned to the India marketing division where he served for 22 years, becoming manager of the Colombo, Ceylon, office in September 1944. The following winter the company recalled him to New York for a special wartime assignment, upon completion of which he was made assistant manager of employee relations in June, 1946.

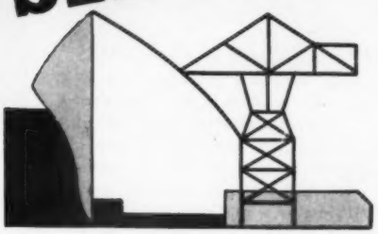
Mr. Waters, who is 54, joined the Standard-Vacuum sales force in 1947 and was stationed in the Netherlands Indies. During his 25 years there he rose to president-director of Standard-Vacuum Sales Company.

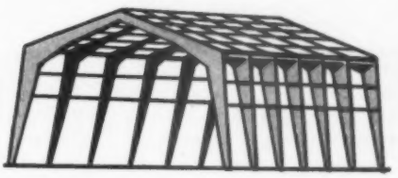
**E. W. BERLIN** has been named head of the producing department of Standard-Vacuum Oil Company. He succeeds H. W. McCobb who was elected a director. After experience in the California producing fields, Mr. Berlin in 1929 joined Nederlandsche Koloniale Petroleum Maatschappij and worked in the Netherlands Indies until the war began. During the war he served as area petroleum officer for the CBI theater. As an additional duty he helped the 20th Bomber Command plan raids over the Netherlands Indies and other Far Eastern areas and flew on some of the missions. Following his release from the armed forces with the rank of colonel, he joined Standard-Vacuum's New York staff in January, 1946, as assistant head of the producing department.

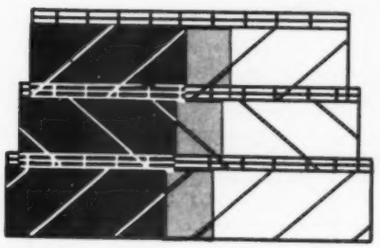
**S. J. STACEY** has been appointed comptroller of the California Texas Oil Co. Ltd., succeeding M. MacIver who was elected vice president in charge of fiscal matters. Mr. Stacey joined The Texas Co. in 1927 and transferred to California Texas Oil Co., Ltd., in 1936 upon the organization of that company. He has held the positions of chief accountant and assistant comptroller. From 1944 to 1946 he was an officer in the United States Navy.

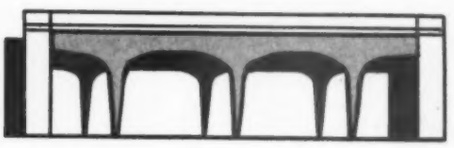
S. J. Stacey

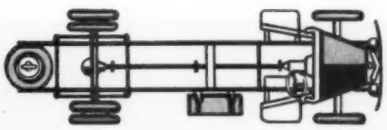
Quasi-Arc
REG. TRADE MARK
THE WORLDS FINEST ARC-WELDING ELECTRODES & EQUIPMENT

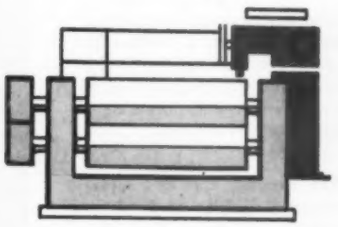

SHIPBUILDING

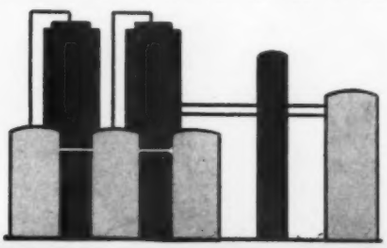
STRUCTURAL STEELWORK



FUEL AND POWER

BRIDGES



TRANSPORT

ENGINEERING



CHEMICAL PLANT

THE QUASI-ARC CO.LTD.

Dr. John R. Bates

**DR. JOHN R. BATES,** formerly assistant to the refining vice president of Sun Oil Co., has been appointed director of the research department. The department is a new creation in which all research work of various company departments will be centered. Dr. Bates will be assisted by Dr. J. Bennett Hill, manager of the development division of the manufacturing department; Dr. John M. Pearson, director of physical research in the production department, and Stewart S. Kurtz, Jr., manager of the experimental division of the manufacturing department.

Sun research activity will be centered at Newton Square, Pa., where construction has been started on a physical laboratory. Eventually it is planned to move other facilities to the center which is 15 miles from Marcus Hook.

**ROBERT W. PACK** has been appointed director of production of Sun Oil Company. He was formerly general manager of the company's Gulf Coast division at Beaumont, Texas. He will move to Philadelphia around January 1. He has been a director since last March. Vice President John G. Pew announced the creation of a management committee to succeed Mr. Pack in the Gulf Coast division. Members are: P. S. Justice, head of land and geological operations; Donelson Caffery, manager of supply and transportation; and Joiner Cartwright, general counsel.

Mr. Pack first joined Sun as assistant to the chief geologist in 1917, and three years later was placed in charge of oil producing operations in the Gulf Coast areas of Louisiana and Texas. At the same time he was elected vice president and general manager of the Sun Pipe Line Company (Texas), a position he held until July 1 of this year. He was associated with the U. S. Geological Survey for seven years prior to joining Sun and had previously served as mineralogist and petrographer for the State of California.

**DR. ROBERT L. SMITH** has been appointed supervisor of the project evaluation division of Sinclair's research and development department at East Chicago. The assignment was made in conjunction with the scheduled expansion of research activities to be carried out at the new laboratories in Harvey, Illinois. Dr. Smith is the author of eight publications dealing with PVT and thermodynamic relations of gases, methods and design for fractional distillation and absorption, and generalized properties by hydrocarbon mixtures. For the past 15 months he has been engaged in process development.

**JAMES TANHAM,** vice president of The Texas Company, is representing the International Organization of Industrial Employers at the United Nations Conference on Trade and Employment at Havana, Cuba, starting November 21. The I.O.I.E. is one of eight international organizations having consultative status with the United Nations. Earlier meetings were held at London, Paris, Geneva and New York.

**DR. H. R. SNOW** has been made plant manager for Pan American Refining Corp. at Texas City, Texas. He succeeds P. J. Sweeney who is now vice president of both Pan American and Mexican Petroleum Corp. of Georgia. B. F. Babin becomes general superintendent at Texas City to succeed Dr. Snow. W. A. Sullender becomes head of the catalytic and distillation department.

**HOWARD C. PYLE** has resigned as vice president of the Bank of America to become president of Continental Consolidated Corp., which has purchased control of Continental Corp., Continental Development Corp., and Continental Northern and Southern Corps. The Continental group operates 63 wells in an extension of the Wilmington field and has some 125 more wells to drill. Mr. Pyle was with Union Oil Co. for many years as geologist and chief petroleum engineer.

## Receives Presidential Citation

A Presidential Citation for "outstanding fidelity and meritorious conduct in aid of the war effort against the common enemies of the United States and its allies in World War II" has been awarded to Walter Levy. In transmitting the award which was presented by Major General William J. Donovan in the office of Park Armstrong, assistant to the Secretary of State, Richmond Keech, secretary of the Medal for Merit Board, explained that it was conferred "in recognition of outstanding services from May, 1942, to August, 1945, as the Office of Strategic Services representatives on the Enemy Oil Committee, subcommittee of the Joint Chief's of Staff, which proved to be an invaluable contribution to the war effort of the United States."

Mr. Levy, a former editorial contributor to WORLD PETROLEUM, is now a member of the State Department in charge of its petroleum research.

John W. Boatwright

**JOHN W. BOATWRIGHT** has been appointed general manager of the distribution economics department of Standard Oil Company (Indiana). He formerly headed the combined sales research and budgeting departments. In his new position he will be responsible for sales budgets, general economic studies, problems of product supply, consumer research studies, economic evaluation studies and profit and loss analyses previously performed in the sales research and coordinating departments. D. S. Warning has been appointed manager of the commercial research division of the distribution economics department, and R. M. Eberly has been appointed manager of the coordinating division of the distribution economics department. Before joining Standard of Indiana in 1932, Mr. Boatwright was an industrial examiner for the Federal Trade Commission for approximately one year and a member of the Northwestern University faculty for three years.

**J. B. HAMBLEN** has been appointed head of the manufacturing department of Pan American Petroleum Corp., at Destrehan, La. He was transferred from Texas City where he was in charge of catalytic and distillation operations.

Presentation of Certificate of Merit to Walter Levy. Left to right; Mrs. Levy, Walter Levy, General William J. Donovan, Park Armstrong, Jr. Dept. of State photo.

*Part of the thousands of miles of Stewarts and Lloyds water and oil pipe-lines supplied to Middle East oil companies.*

*Stewarts and Lloyds Limited are suppliers of all oil-country tubular goods.*

STEWARTS AND LLOYDS LIMITED
GLASGOW · BIRMINGHAM · LONDON

S&L

## Completes Pressure Plant

Sun Oil Co. has completed a $200,000 pressure-maintenance plant in the Norwich field in Michigan. The plant recompresses 3.5 million cubic feet of gas to more than 2,000 psi for return to the producing formation. Sun discovered the Norwich field in 1942 and has drilled 39 of the 42 producers in the field.

## New Research Laboratory

Shell Oil Co., Inc., dedicated its new exploration and production research laboratory in Houston on December 5. The laboratory is completely equipped for developing and perfecting techniques of oil finding and recovery. Director is Dr. Harold Gershinowitz. Associate directors are Dr. M. King Hubert and J. P. Murphy.

## Asphalt Laboratory

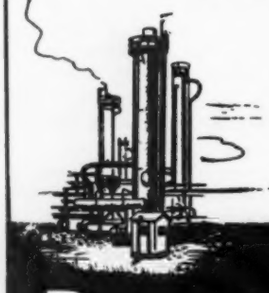
A new laboratory devoted exclusively to the study of asphalt and its application has recently been established at Wood River, Illinois, by the Shell Oil Co. One of the main objectives is to isolate and correct common causes of road failure. New uses will be sought as well as improvements in the product.

*Making Metal Behave is Our Business*

MANUFACTURERS of ASME, API-ASME VESSELS

**OIL and GAS EQUIPMENT**

**PROMPT DELIVERY ASSURED**



PLEASE SEND INQUIRIES to

PETROLEUM ENGINEERING DEPARTMENT

3301 S. LAMAR DALLAS, TEXAS

**BUTANE EQUIPMENT CO., INC.**


## New Pulsation Dampener

The pulsation dampener, designed to cut the surge and shock of many types of reciprocating pumps, particularly oil field mud pumps, has been brought out by Baroid's Specialties Department. Reduction in pulsation on this type of pump reduces costs by cutting horsepower loss, repairs and services, parts replacement, use of bumper hose, air cushion standpipes and other extra equipment. The pulsation dampener has already found a place on numerous oil field pumps.

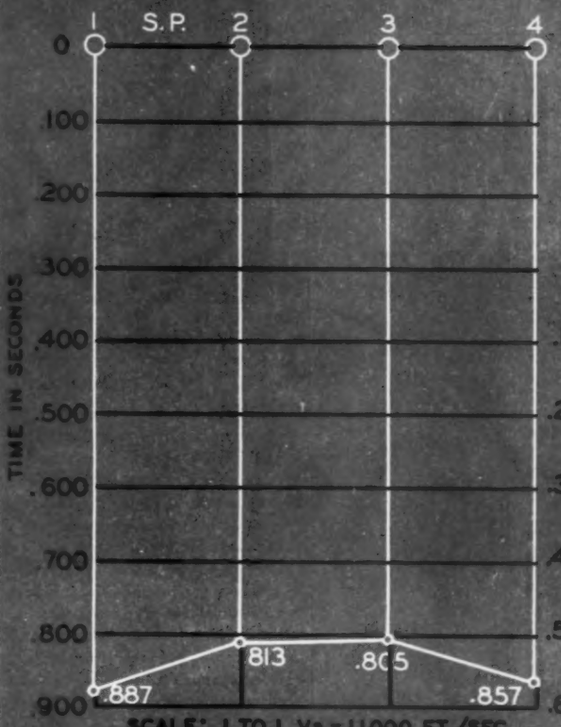
Special dampeners for pipe line pumps, cement trucks and other reciprocating pump installations also reduce damage to equipment by providing smoother and more efficient operation. Their installation enables power pumps to be compounded which also reduces the need for pump liner changes to accommodate greater pressure demand with increased depth. Considerable savings in fuel and upkeep are effected by cutting horsepower demand on pump engines.

In principle the dampeners consist of one or a series of enclosed, inflated rubber cartridges coupled to the discharge line of the pump. The surge generated by the output stroke of the pump causes the inflated rubber cell or cells to contract slightly, thus absorbing the impulse from the pump stroke. With the passing of the initial surge, the rubber bladder expands to aid in maintaining a steady even flow. Cast of special alloy steel, the housing and heads of the dampeners will withstand pressures up to 3,000 pounds per square inch. A specially compounded synthetic rubber, molded to a steel mandrel, provides a tough and enduring bladder. Each bladder receives its charge of inert gas at the factory where each is sealed and replacements are available from supply stores.

Single, duplex or triplex installations attached to mud pumps will accommodate the full range of horsepower drive. The single unit accommodates the output of all pumps up to those pulled by a 150 hp engine; the two-unit installation up to the size of those operated by a 300 hp engine; while the triplex will handle all pumps driven by engines greater than 300 hp.

A specially fabricated Baroid dampener containing four cells or cartridges will eliminate the destructive pulsation coming from pipe line booster pumps. A smaller, light-weight unit, capable of withstanding 12,000 psi pressure and especialy designed for cement pumps, but adaptable to many other small reciprocating pumps, embodies a similar principle but quite different construction.

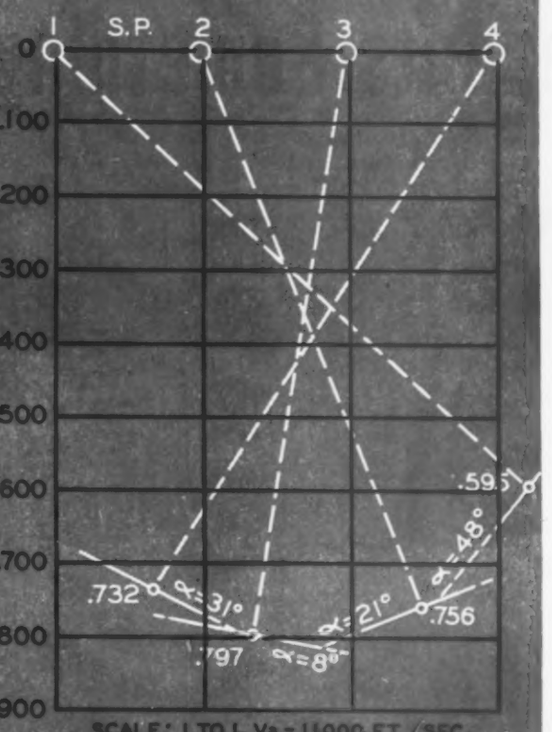
# Steep Dip Shooting




*Undisplaced* data plotted as if originating vertically below surface recording points. Note apparent anticline. (Above)

*Displaced* data from same records plotted at calculated sources of reflections along the line of profile. Note true structural attitude is synclinal. (Right)

Steep Dip Shooting requires an appreciation of the lateral migration of the reflecting points relative to surface control. Failure to properly evaluate this factor may result in erroneous interpretations.




Seismograph Service Corporation

TULSA, OKLAHOMA, U.S.A.

## Heads Engineering Department

A new petroleum engineering department has been formed at Butane Equipment Co., Dallas, Texas, under the direction of John W. Pratt, Jr., nephew of Wallace E. Pratt, former vice president of the Standard Oil Co. (N.J.). During the war John W. Pratt, Jr., spent 30 months as a captain with the Corps of Engineers, U. S. Army, in various countries overseas.

The plant division of Butane Equipment Co.'s petroleum engineering department has been enlarged recently by the addition of new equipment designed for fast and efficient manufacture of refinery equipment. Four steel rolls, capable of rolling steel up to 2 inches thick, as well as cranes and trunnions to support up to 80 thousand pounds, are a part of the plant's machinery covering 31,000 square feet of floor space.

## New Camera

Fairchild Camera & Instrument Corp. is now making limited deliveries, with production increases scheduled, on its new cartographic camera designed to provide aerial photographs of rigid precision. The 9 x 9 inch photos meet requirements for topographic and planimetric maps needed in geological exploration.

The cartographic camera has several original features. It may be operated either automatically or semi-automatically, has two cones, lying one within the other. The inner cone contains the focal plane and the optical system and is readily removable as a complete unit for calibration. The outer cone contains all operating mechanisms, readily accessible for ease in servicing. The magazine accommodates a 180-foot roll of film, rigidly held to assure absolute film flatness during exposure.


SPERRY-SUN

Presents Something New

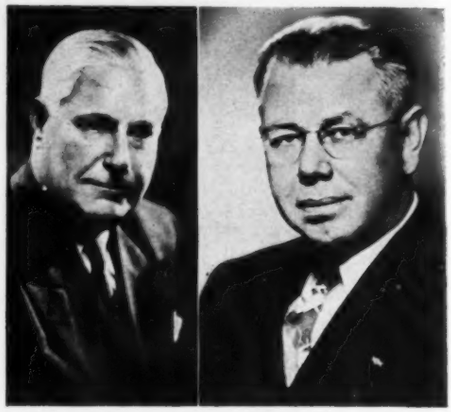
*How Fast Does It* DROP?

Dropping Time Indicators

*Write or ask our representative for full details.*

SPERRY-SUN WELL SURVEYING COMPANY

Offices: Philadelphia, Pa.; Houston, Corpus Christi, Falfurrias, Marshall, Odessa, Texas; Lafayette, La.; Long Beach, Bakersfield, Calif.; Oklahoma City, Okla.; Moulden Oil Field Services, Casper, Wyo.

D. F. Axelson R. M. Pease

## D. F. Axelson Retires

D. F. Axelson has resigned as vice president in charge of manufacturing for Axelson Manufacturing Company, Los Angeles. His retirement marks the close of some forty years' association with the company, founded in 1892 by his father and uncle.

Mr. Axelson's retirement has resulted in the promotion of R. M. "Bob" Pease, formerly vice president and manager of the St. Louis plant. Mr. Pease is now vice president and assistant general manager with headquarters at the main plant in Los Angeles. Also promoted is Mr. Victor "Vic" Mancuso, formerly works manager, to the position of vice president in charge of manufacturing. Mr. Pease first joined the Axelson organization in 1917; Mr. Mancuso has an uninterrupted service record with the company since 1919.

## Bay Modernizing Refineries

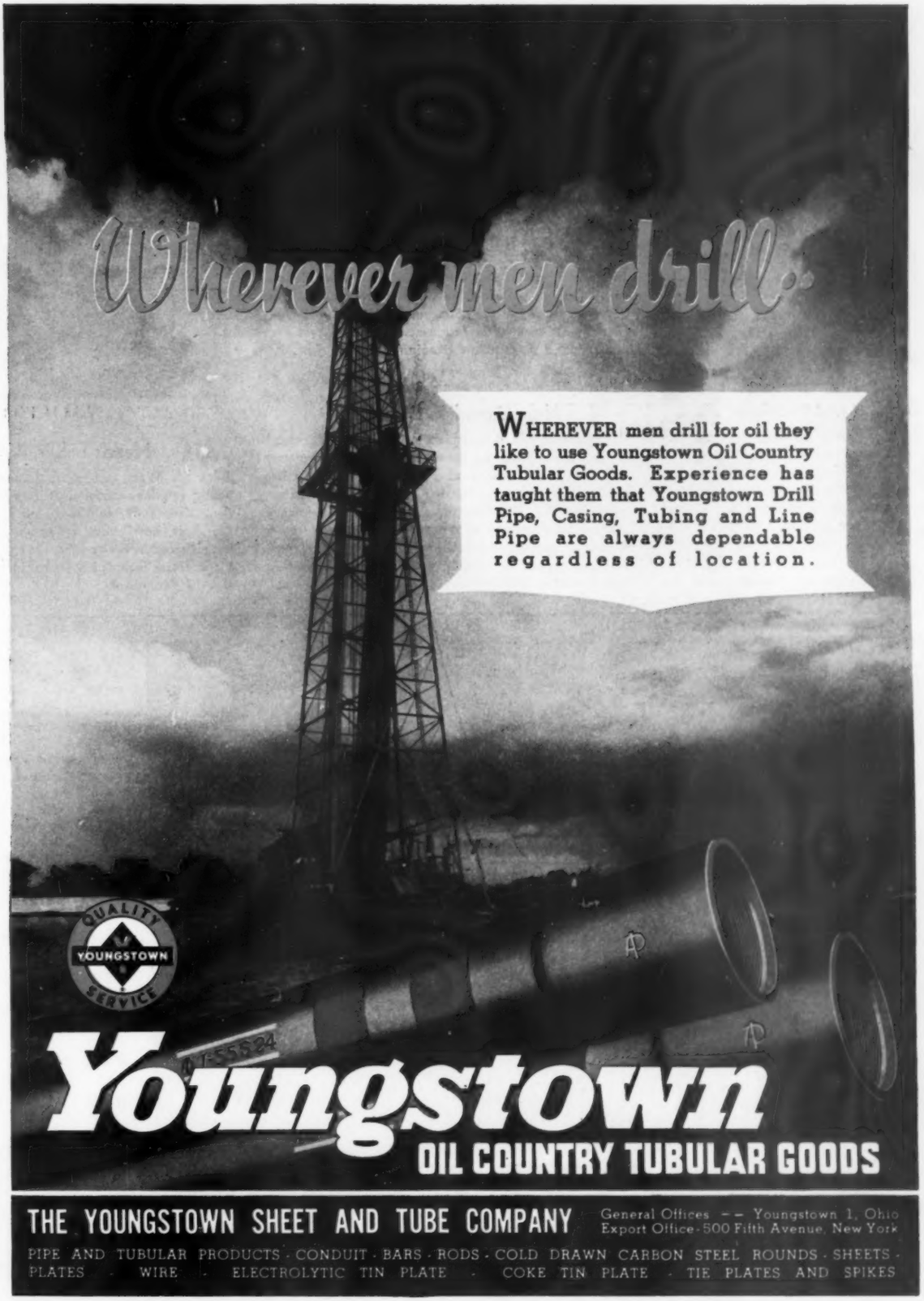
Bay Petroleum Corp. is installing a U.O.P. thermal reforming unit and a catalytic polymerization unit at its Denver refinery, and a thermal reforming unit at McPherson, with designs and supervision of Universal Oil Products Co. Each of the reforming units will have a capacity rating of 1000 barrels a day. The facilities at Denver are being built by Bay's own construction force. The work at McPherson is being done by the Refinery Engineering Company.

## Buell F. Jones

Buell F. Jones, 55, vice president and general counsel of Standard Oil Co. (Ind.), died November 17 in Chicago following an extended illness. He joined Standard of Indiana in 1930 as an attorney and served the company in connection with numerous important matters in subsequent years. He was made general counsel in 1940, was elected to the board of directors in 1942 and made a vice president in 1945.

## Moves Offices

The National Geophysical Company, Inc., has moved its executive and accounting offices from the Tower Petroleum Building to 8800 Lemmon Avenue, Dallas, Texas. The new location will house the company's main offices, laboratory, research department and drill shop.


Wherever men drill
WHEREVER men drill for oil they like to use Youngstown Oil Country Tubular Goods. Experience has taught them that Youngstown Drill Pipe, Casing, Tubing and Line Pipe are always dependable regardless of location.
QUALITY
YOUNGSTOWN
SERVICE
Youngstown
OIL COUNTRY TUBULAR GOODS

THE YOUNGSTOWN SHEET AND TUBE COMPANY

General Offices -- Youngstown 1, Ohio
Export Office - 500 Fifth Avenue, New York

PIPE AND TUBULAR PRODUCTS - CONDUIT - BARS - RODS - COLD DRAWN CARBON STEEL ROUNDS - SHEETS - PLATES - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - TIE PLATES AND SPIKES

## Oil Burning Locomotives

The Great Western Railway recently brought into use the largest oil storage plant on the line at Old Oak Common, London. One of the sixteen oil storage plants rendered necessary by the conversion of locomotives from coal to oil, it is designed for a total storage capacity of 352,000 gallons.

Ten offloading points for rail tank cars and three fueling points for locomotives are provided, and the whole of the oil lines both inside and outside the pump house are steam-heated by tracer pipe lines bound to the oil pipes under a coat of lagging. Provision is also made for a supply of steam through flexible connections to the traveling rail tank cars for preheating the oil before pumping. The fueling points for locomotives are G.W.R. design and provide for free movement on the end of the fueling arm without any glanded joints through which oil has to pass. An electric light automatically switches on when the end of the job arm projects into the mouth of the filler hole on the locomotive tender. Two double-acting duplex steam-driven pumps, each of 10,000 gallons per hour capacity, are provided in the pump house, and the valve connections to these pumps are so arranged that either pump can undertake the unloading of rail tank cars to the storage tanks or delivering oil from the storage tanks to the locomotives, as desired.

In addition to Old Oak Common, eight further depots, viz., Reading, Didcot, Swindow, Newton Abbot, Severn Tunnel Junction, Newport (Mon), Cardiff and Llanelly are also in operation and erection work is at an advanced stage at the remaining seven depots.

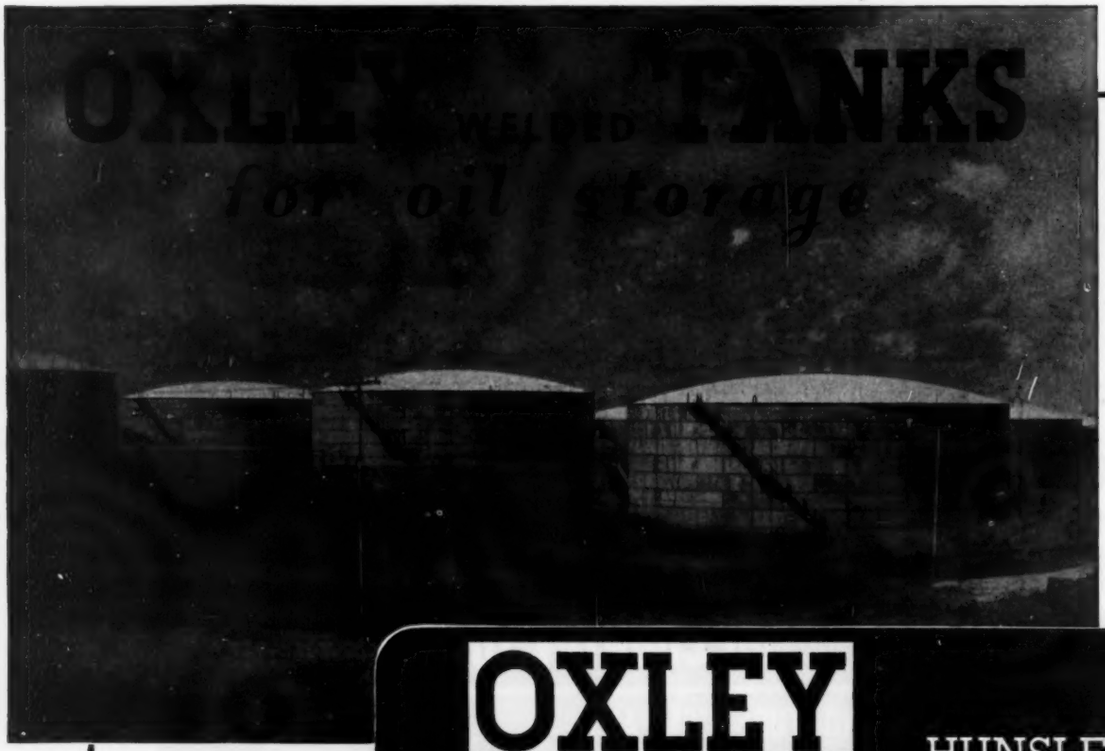
## New Canadian Discovery

California Standard Company, subsidiary of Standard of California, made an important discovery of a new oil field in the plains of Alberta about 150 miles southeast of Calgary. Its Bantry No. 1 jointly drilled with Imperial Oil Limited, indicated a satisfactory commercial discovery of clean 24 gravity crude on a 40-minute production test from a depth of 3,259 feet. Nearest present source of production is California Standard's South Princess field eleven miles northeast. The discovery is near the center of a large block of land obtained from the Canadian Pacific Railway. The well will be carried to deeper horizons before being completed for production.

John M. West

## Heads Public Relations

John M. West has been appointed director of the public relations division of Foster Wheeler Corporation, New York, in charge of advertising, publicity, literature and house organs. Mr. West has been with Foster Wheeler since January, 1940. His previous duties included sales engineering as well as design of equipment.


The illustration shows a group of Arc Welded Tanks for oil storage erected by us in Trinidad. All the work was executed under the supervision of our own engineers on the site.

ERECTED AT HOME or ABROAD

•

Oxley are specialists in the design and erection of tanks. Operators and plant are sent to any part of the world.

OXLEY ENGINEERING CO. LTD.

HUNSLET LEEDS, 10

Telephone Leeds 32521 · Telegrams Oxbros Leeds

London Office · WINCHESTER HOUSE OLD BROAD STREET, LONDON, E.C.2

W84

# BURTON'S *Patent*

## STEEL SCAFFOLDING

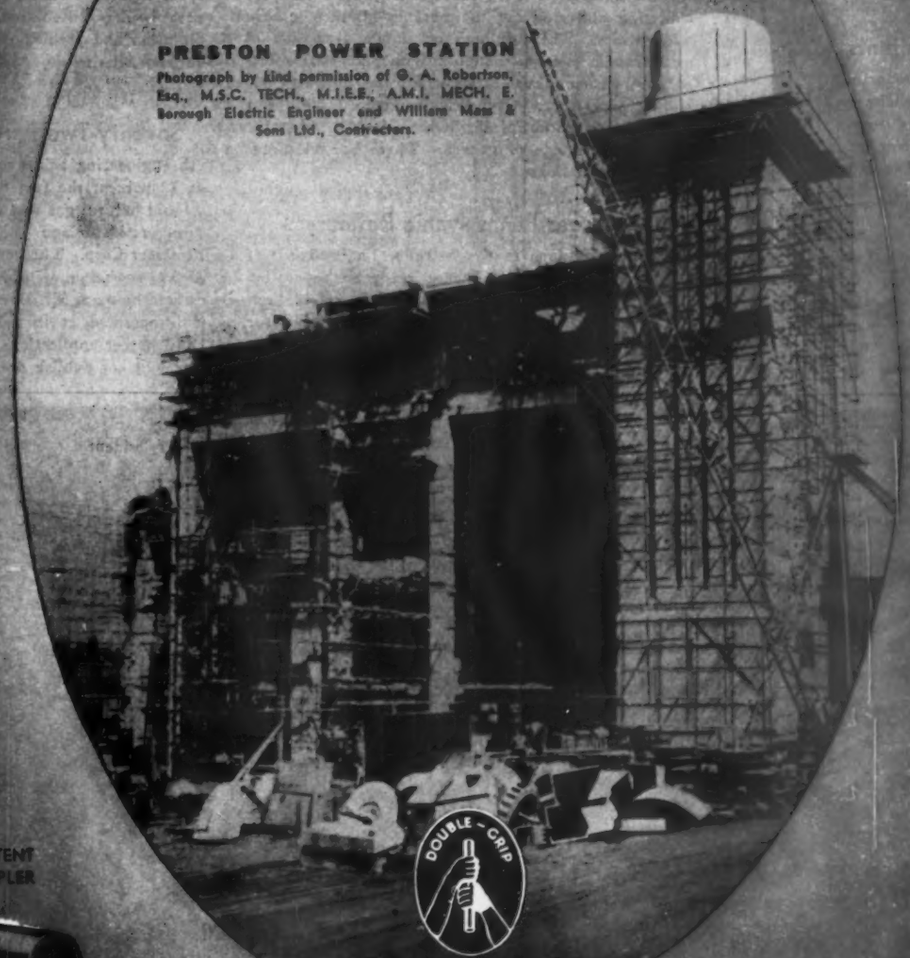
### FOR SPEED, SAFETY & ECONOMY

BURTON'S PATENT DOUBLE COUPLER

BURTON'S PATENT SWIVEL COUPLER

**PRESTON POWER STATION**

Photograph by kind permission of G. A. Robertson, Esq., M.S.C. TECH., M.I.E.E., A.M.I. MECH. E. Borough Electric Engineer and Williams Mess & Sons Ltd., Contractors.



BURTON'S PATENT PUTLOG COUPLER

DOUBLE-GRIP

## LONDON & MIDLAND STEEL SCAFFOLDING CO. LTD.

ST. LUKE'S WORKS, OLD HILL, STAFFORDSHIRE

Telephone: 4237/8 Cradley Heath. Telegrams: Dubolgrip, Old Hill, Staffs.

LONDON OFFICES: IDDESLEIGH HOUSE, CAXTON STREET, S. W. 1.

Telephone: Abbey 4482/3 Telegrams: Dubolgrip, Sowest, London

## Contracts To Sell Chemicals

Stanolind Oil & Gas Co. has sold the prospective output of water-soluble oxygenated chemicals from its Synthol plant to U. S. Industrial Chemicals, Inc. The sale includes products of from two to four carbon atoms per molecule. Plans are not yet complete for marketing higher molecular weight chemicals, some of which have never previously been manufactured on a quantity basis. Both types of chemicals will be products of the Fischer-Tropsch synthesis using natural gas as raw material.

Stanolind plans to build recovery plants adjacent to both its Kansas plant and the Carthage Hydrocol plant in Texas. U.S.I. will build additional plants at both points to produce chemicals from some of the Synthol raw materials. Others not consumed at the U.S.I. plants will be sold as such. Each of the Stanolind plants is expected to produce upwards of 100 million pounds of chemicals yearly. These will include alcohols, aldehydes, acids and ketones. Production will begin in 1949.

## Government Patents

A list of patents owned by the Department of the Interior has been issued by the solicitor. The patents are available for licensing on a royalty-free basis. Copies are obtainable from the Patent Office, and applications for licensing may be placed with the solicitor. Following is a list of patents which may have some application in the oil industry: No. 2,118,829, preparation of cobalt-copper catalysts; No. 2,255,069, method and apparatus for separating and concentrating gases; No. 2,283,954, apparatus for testing the embrittlement cracking characteristics of solutions; No. 2,283,955, means for and methods of testing embrittlement cracking characteristics of solutions; No. 2,297,-670, method of protecting boilers and the like against embrittlement; No. 2,364,088, core drilling; No. 2,366,-184, production of potable water from saline solutions; and No. 2,411,157, means for collecting gas analysis samples.

## Glaessner's Micropaleontology

Principles of Micropaleontology, by Martin F. Glaessner, published 1947 by John Wiley & Sons, Inc., New York; 296 pages, $6.00.

This is an American edition of a book that was first published in Australia in 1945, and its obvious importance as a major contribution in this field is attested by its republication in the United States. Micropaleontology has become of large and increasing value in the exploration for oil because it often serves for the identification of formations and strata where all other means are lacking; petroleum geologists would now find it hard to get along without the assistance of this science.

The author gives an extensive survey of the major groups of microfossils, with prominent reference to the foraminifera. He gives working definitions for collecting and studying the various families, genera and species. There follows an ample discussion of stratigraphic micropaleontology with particular reference to petroleum exploration in Europe, Asia and adjoining experience. Of particular interest will be a revised classification of the foraminifera showing the stratigraphic range of genera. There are 14 plates and 64 illustrations.

## Enlarges Pennsylvania Refinery

Extensive additions to the Petrolia, Pa., refinery of L. Sonneborn Sons, Inc., were ready for operation in November. A newly-developed water soluble sulfonate called "hydronate" will be manufactured for further processing and sale by detergent manufacturers. The Sonneborn sulfuric acid plant capacity is being doubled and will produce 100 tons daily. This entire quantity will be used at the refinery in the production of petroleum specialties. The company manufactures white oils, deodorized kerosenes, petrolatums, petroleum sulfonates and micro-crystalline waxes.

## Buys War Plant

Ashland Oil & Refining Co., Ashland, Ky., has purchased the government-owned refinery near Catlettsburg, Ky., from the War Assets Administration. Price was $2,150,000. The plant is on 110 acres of land with three main processing units, a TCC catalytic cracking unit, feed concentration unit, U.O.P. butane isomerization and HF alkylation units.

## Opens New Area Headquarters

A new administrative area of the Shell Oil Co., Inc., has been established with headquarters in New Orleans to keep pace with expansion in exploration and production activities. The new office will occupy four floors of the Richards Building plus some additional space in the Maritime Building. The manager of the area is E. G. Robinson, who is responsible for exploration and production operations in Louisiana, Arkansas, Mississippi, Alabama and other southeastern states.

## Seventy-Two Percent Saving Claimed

An engineering achievement that reduces by as much as 72 percent the fuel cost of engines burning diesel oil and natural gas was announced by Ralph L. Boyer, vice president and chief engineer of the Cooper-Bessemer Corp. The new development makes the gas-diesel engine the most efficient power unit ever created by man, Mr. Boyer said, regardless of whether it is operated at its full capacity or at light load. Until patent applications are perfected, Cooper-Bessemer will not publish details of the new development.

# Can our foreign OIL interests supply America's need?

Here is a thoroughly revealing report on American oil operations abroad—combining the romantic history of oil field development with a complete, factual survey of the extent and scope of American petroleum investment and activities in foreign countries. The book traces carefully the entire history of American foreign oil development, describing financial, political and production factors; the varied complexities of the American position; economic and other advantages to ourselves and foreign nationals.

JUST OUT

## American Oil Operations Abroad

**By Leonard M. Fanning**

270 pages, 5½ x 8, 246 photographs, 76 tables, 24 charts and graphs, $5.00.

Provides you with a complete account of American oil investments and operations in foreign countries—from hardships and problems of oil development in faraway lands, to the pertinent facts that set the important implications of the present-day international oil picture in bold relief. All areas in both hemispheres where American oil companies have sent men and equipment are thoroughly described, and the advantages offered by each are completely analyzed.

The book thoroughly describes the unique problems involved in foreign oil development—the political and economic hazards, nationalism in various countries, international competition, cartels, confiscation, physical and financial risks, etc.

ADDRESS YOUR ORDER TO:

**WORLD PETROLEUM**

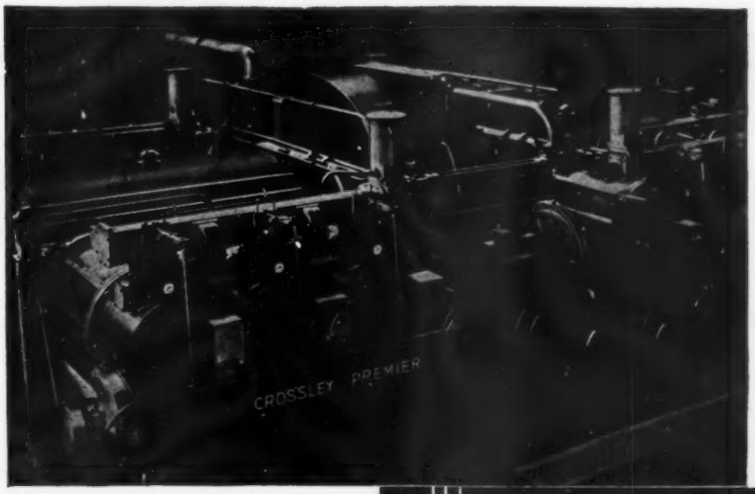
2 West 45th Street New York 19, N. Y.

of highest precision for the Oil Industry. Indicators, recorders, controllers and transmitters of temperature, pressure and liquid level.

NEGRETTI & ZAMBRA LTD

122 Regent Street, London, W.1






*1,800 B H P vis-a-vis Gas Engine operating on natural gas. A Trinidad Oilfields Installation.*

# POWER BY CROSSLEY -PREMIER

UP TO 3000 BHP

RELIABLE ECONOMICAL
ACCESSIBLE SIMPLE

CROSSLEY-PREMIER ENGINES LTD

SANDIACRE, Nr. NOTTINGHAM

P45

**M-SCOPE** Leak Detector and Buried Pipe Finder

***FIND THAT LEAK!***

SAVE TIME, MONEY, MESS AND TROUBLE

This efficient little device for detecting leaks in pipe lines may be used by anyone without special engineering experience. All you do is make contact with a pipe or valve and the leak sound is perfectly audible in the head set. Shows you just where to dig. For the plumber, inspector and maintenance man, this device is invaluable.

**$67.50**

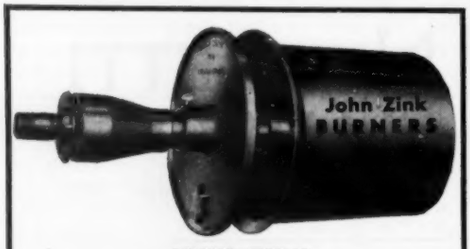
Delivers the Midget Leak Detector, illus. Others to $425.

***Write for Complete Information***

**FISHER RESEARCH LABORATORY, INC.**

PALO ALTO *Direct Teletype* CALIFORNIA






**— JOHN ZINK —**

**HORIZONTAL BI-MIX BURNERS**

. . . are the only burners that satisfactorily burn gases of varying heat values without adjustment. They are not damaged by slugs of oil, gasoline or water that sometimes blow through them from the fuel line.

***Write for Literature***

**JOHN ZINK COMPANY**

4401 S. Peoria Tulsa, Oklahoma

## ERP Makes Heavy Demands

*(Continued from page 41)*

in cooperation with the Navy. Such construction would release additional numbers of older tankers for sale to foreigners.

It is further suggested by the Harriman committee that the presently planned balance between foreign construction of dry cargo and tanker vessels be shifted to provide for more tanker construction and less dry cargo. In order to meet any possible tanker operating contingency, Congress should extend beyond March 1 the authority for operation of government-owned tankers under general agency agreements. In concluding discussion of the oil phases of ERP, the committee says:

"The CEEC program assumes a substantial conversion of European manufacturing and utility industries to oil-burning equipment. It also assumes a very substantial increase in overall industrial capacity, and that new capacity being built is designed to burn oil rather than coal. It appears from other sections of the program that many of the European production and plant expansion goals are overly optimistic. They are dependent upon optimum conditions for production in Europe and upon requested imports from the United States which will not be available. Insofar as European production and plant expansion fall short of CEEC goals because of indigenous factors or shortfalls in imports from the United States and other sources, petroleum requirements will also be reduced below the stated level. Consequently, the instability of the European countries to procure their stated petroleum requirements in the world market will not hamper their economic recovery program as much as would be indicated by comparison of requirements against supply. Any special downward adjustments in petroleum requirements which may be necessary because of shortfalls in imports of raw materials and machinery should be made on an individual country basis as the program develops.

Interior Secretary Krug says the logical source of petroleum for Europe is the Middle East, where sources already developed are ready to deliver large additional amounts of crude oil as soon as transportation equipment is available to carry it away and refinery capacity to process it. He points out that arrangements already have been made to transfer to operation in the Middle East tankers formerly idle or engaged in the carriage of oil from the United States. As a result supplies from the Middle East, and there will be smaller dependence on the United States. The primary need for rebuilding Europe's petroleum economy is transportation capacity to carry Middle Eastern oil to European markets, he reports.

"It is uncertain whether or not supplies from domestic resources can be increased over the four-year period to keep up with the domestic demand," Krug advises. "Our imports to Europe and elsewhere can be expected to decline over the next few years."

***Write for this helpful booklet***

**You are not obligated**

THE **HARSHAW CHEMICAL** CO.

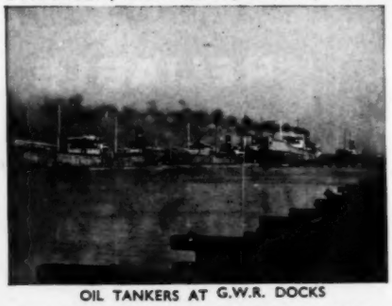
1945 East 97th Street, Cleveland 6, Ohio

BRANCHES IN PRINCIPAL CITIES



**OIL DISTRIBUTION**

The Great Western Railway Company's South Wales Docks at CARDIFF, SWANSEA, NEWPORT, BARRY, PORT TALBOT and PENARTH (Harbour) are excellent terminals for oil distribution.



OIL TANKERS AT G.W.R. DOCKS

**SITES FOR NEW DEPOTS ARE AVAILABLE**

• • • • • •

Information may be obtained from :—

T. D. SLATTERY,
Associated British & Irish Railways Inc.
9, Rockefeller Plaza (16, West 49th Street)
New York, 20,

or direct from :—

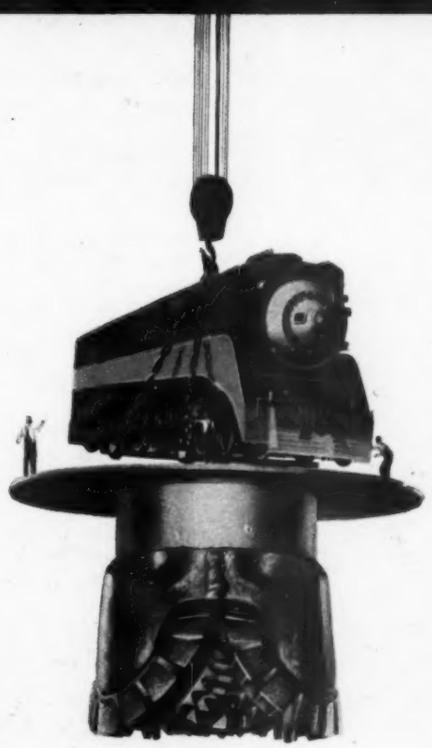
LESLIE E. FORD, CHIEF DOCKS MANAGER, GREAT WESTERN RAILWAY, CARDIFF

FOR HEAVY WEIGHT DRILLING

WHEN THE GOING IS TOUGH

## CHOOSE HUGHES

# W7-R



Hughes W7R Rock Bit is specially designed for extremely hard, abrasive formations such as chert, chat, pyrite, granite, quartzite, and dolomitic and quartzitic sand rock.

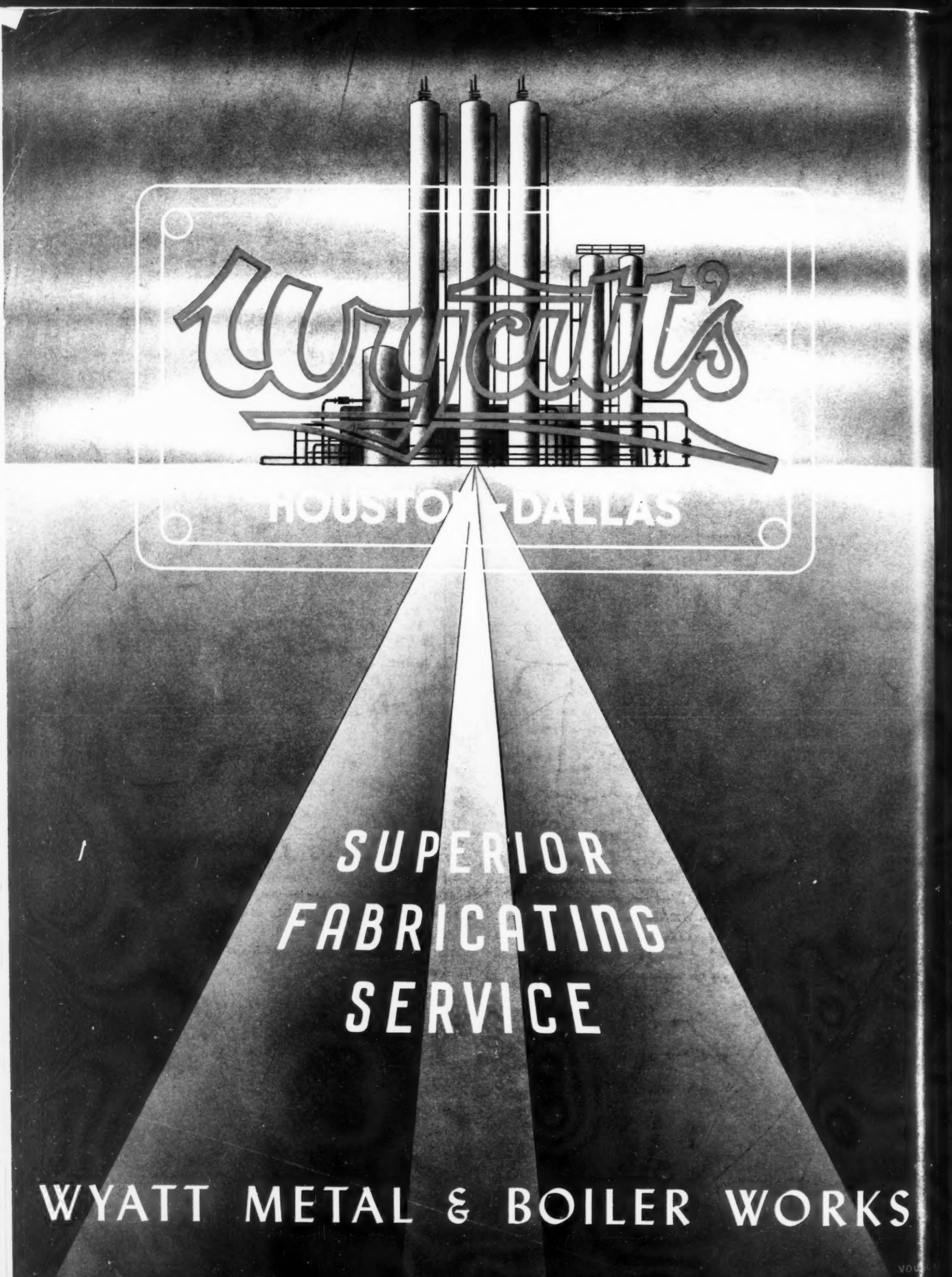
Hughes W7R embodies strong, closely-spaced teeth. Cutter design provides a chipping, crushing action and has a strongly fortified gage area to afford maximum resistance to gage wear for maintaining full-gage hole.

While the W7R Tricone is adaptable to all practical drilling weights and rotary speeds, it is specially designed for those formations generally requiring heavy weights such as 3000 to 4000 lbs. per inch diameter of bit and rotary speeds from 40 to 50 R.P.M.

This is another example of Hughes "Engineered Solution" for every drilling problem!

Hughes TOOL COMPANY
HOUSTON, TEXAS

*Standard of the Industry*


Wyatt's
HOUSTON - DALLAS
SUPERIOR
FABRICATING
SERVICE
WYATT METAL & BOILER WORKS